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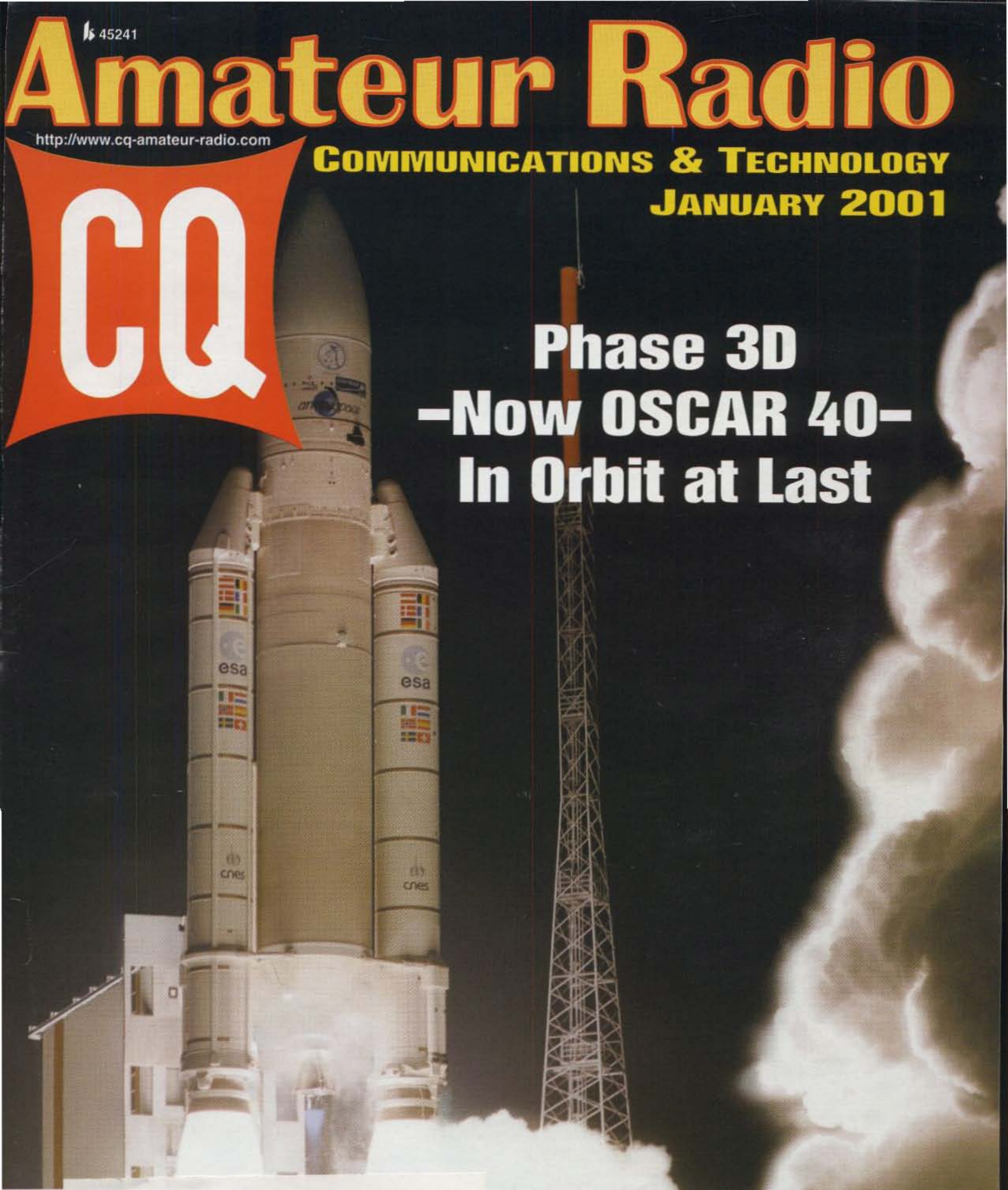

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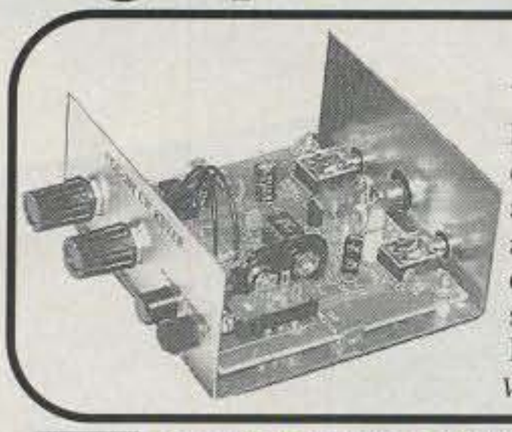

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ON THE COVER: Ariane Flight V135 lifts off from the European Space Agency's South American spaceport in Kourou, French Guiana, early on November 16, 2000 (UTC). The Ariane-5 rocket launched four satellites into orbit, including the long-awaited Phase 3D amateur satellite, now known as AMSAT-OSCAR 40. See launch details on page 11. (Cover photo courtesy Arianespace)

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Ham Radio News

From The CQ Newsroom

Phase 3D Flies— Now AO-40

After nearly four years of waiting, the international Phase 3D satellite is finally in orbit, and is now known as AMSAT-OSCAR 40 (AO-40). The satellite was lofted into orbit from French Guiana early on November 16 (UTC) by an Ariane 5 rocket. *CQ* provided live launch coverage on its website. For details of the launch, see "Amateur Satellites" on page 11.

ARISS On the Air

Amateur Radio on the International Space Station (ARISS) is on the air. Less than two weeks after taking up residence on the space station, now dubbed "Alpha," the all-ham crew hooked up their ham gear (just a 2 meter handheld at this point) and did engineering tests with fellow hams at space facilities in Russia and the United States. Packet tests were to follow, with no word yet on when the rest of us might expect a chance to contact them. See this month's "VHF-Plus" column, beginning on page 112, for more details.

Russia to De-Orbit Mir

The Russian government has decided to give up on the Mir space station, and now plans to bring the aging spacecraft down in a controlled re-entry at the end of February. As noted in *The ARRL Letter,* Mir has been the pride of the Russian space program for more than a dozen years, and has been a primary focus of ham radio in space operations. In addition to providing contacts with schools and just-plain QSOs between cosmonauts/astronauts and hams on earth, Mir's ham station was pressed into emergency service after a fire aboard the craft and a collision with a supply ship that nearly ended in disaster.

The head of Russia's space agency said the ship is in too poor a state of repair to remain in orbit much longer, and that it would be brought down in the Pacific Ocean off Australia between February 26 and 28.

FCC: No Expansion of PRB-1

"Is that your final answer?" ARRL President Jim Haynie, W5JBP, said he was tempted to ask that question of Kathleen Ham, Deputy Chief of the FCC's Wireless Telecommunications Bureau, after she turned down for a second time the League's petition to extend the reach of the Commission's limited pre-emption of local antenna laws to include private deed restrictions. Ham had written the decision to deny the League's original petition, as well as the denial of the petition for reconsideration. She said the bureau was not convinced that the ARRL's arguments warranted the inclusion of so-called "CC&Rs" under the provisions of PRB-1, which require "reasonable accommodation" of amateur antennas by local governments. Many private developments ban all outdoor antennas, except for over-the-air television and satellite antennas, which the FCC has previously said must be permitted.

The latest ruling did attempt to clarify what the FCC considers "reasonable." Essentially, it said that any amateur antenna similar in size and shape to other antennas already permitted in residential areas must be allowed. On the other hand, it said banning antennas of the type "commonly and universally associated with those that one finds in a factory area or an industrialized complex" would not be unreasonable. The ruling did not say which category a tribander at 65 feet might fall into.

At press time, the ARRL was deciding whether to request a review of the decision by the FCC commissioners themselves. (For more on this story, see this month's "Zero Bias" editorial.)

Washington Tower Law Website

A ham in Auburn, Washington, is trying to line up support for legislation to enact statewide standards for amateur radio towers, and to pre-empt local ordinances that conflict with them. George Hutchinson, W7KSJ, has set up a website—<http://www.hamtowerlaw.com>, courtesy of qsl.net's Al Waller, K3TKJ—to collect information in support of the law. The bill is sponsored by State Senator Pam Roach.

QCWA: Restore Pre-1968 Privileges

When the FCC announced its restructuring decision just about a year ago, one of its main concerns was that no currently licensed hams would lose any privileges. That was *not* the case in 1968, when the FCC enacted "incentive licensing." Thousands of General, Conditional, and Advanced Class hams lost operating privileges as the HF ham bands were carved up into subbands for different license classes. Many hams are still upset, and now, the Quarter Century Wireless Association says the FCC should give back those privileges to any hams who lost them, and who haven't upgraded in the intervening 32 years.

In a petition for rule making filed in late October, QCWA asked the FCC to require volunteer examiners to grant credit for Element 4—the Extra Class written exam—to anyone holding a pre-1968 Conditional, General, or Advanced Class license. This would essentially allow those hams an "instant upgrade" to Extra without taking an additional exam. The group admits there are "at most a few thousand amateur operators" who would benefit from the proposal, but it says its primary goal is "a prompt ending of the injustice being suffered by those within its constituency." At press time, the FCC had not indicated what action, if any, it might take on the petition.

On a lighter note, QCWA announced that its 2001 international convention will be held on board a cruise ship! The floating convention will last eight days and include visits to four Caribbean ports of call. For more information, visit the group's website: <http://www.qcwa.org>.

Michigan Scanner Bill Withdrawn

A Michigan lawmaker who introduced a bill to require state permits in order to have a radio capable of tuning police frequencies in your car has withdrawn the measure after meeting with a group of concerned hams from the Livonia Amateur Radio Club. The *Detroit News* reported on November 5 that State Rep. Mike Kowall withdrew the bill after being persuaded that its effect would be much broader than he'd intended. According to the *News*, Kowall said he wrote the bill to prevent criminals from using radios to escape police, but didn't intend punish others. "I'm trying to protect the police and the public," he told the *News*, "but I don't want to curtail civil rights in the process."

Members of the Livonia club promised to work with Kowall on a revised version that focuses on using a radio in committing a crime or escaping capture, rather than mere possession. (*CQ salutes the Livonia ARC for focusing on preserving the rights of all legitimate radio users, rather than only licensed amateurs—ed.)*

Additional and updated news is available on the Ham Radio News page of the CQ website at <http://www.cq-amateur-radio.com>. For breaking news stories, plus info on additional items of interest, sign up for CQ's free online newsletter service. Just click on "CQ Newsletter" on the home page of our website.

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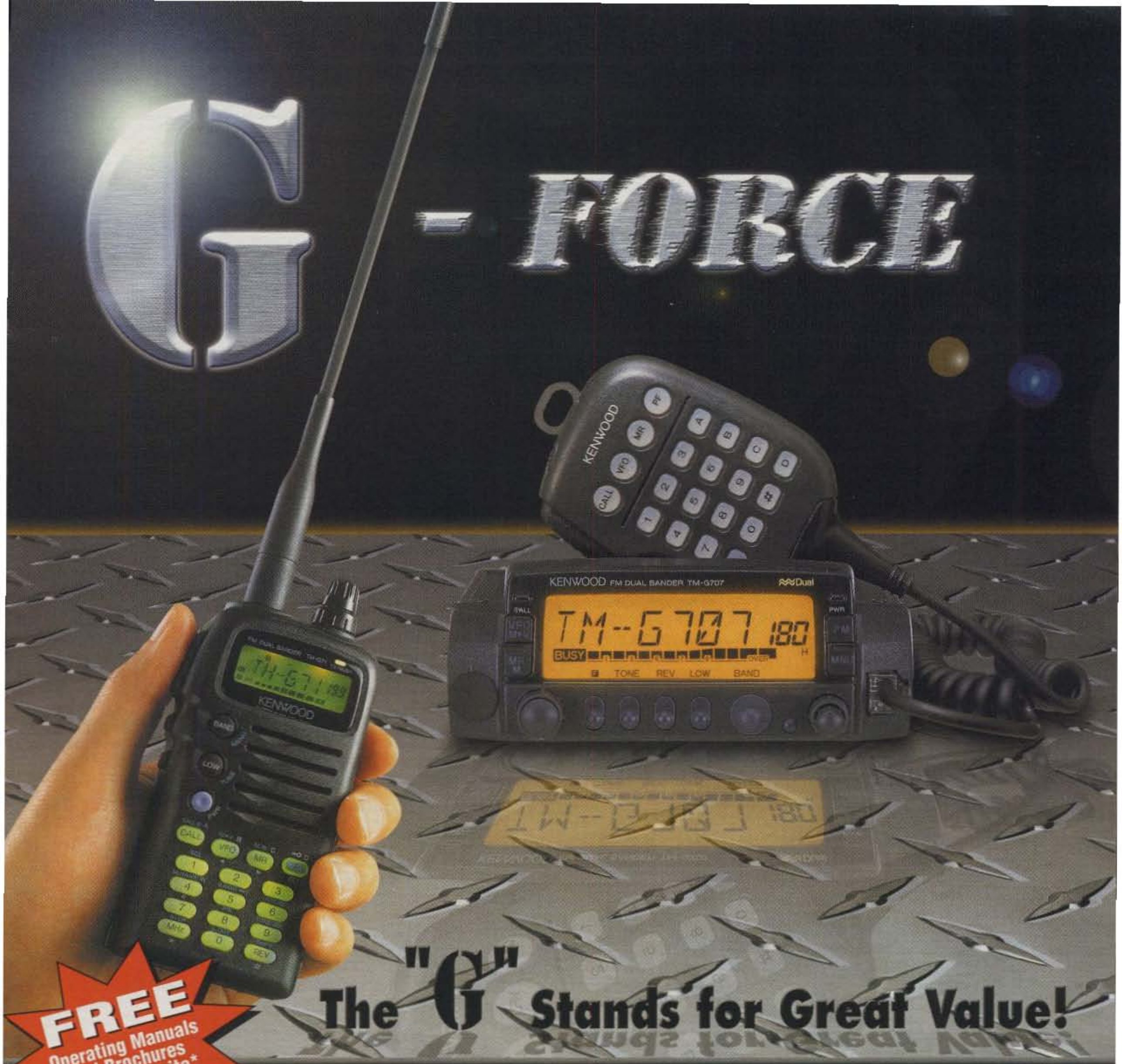

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Zero Bias

BY RICH MOSESON, W2VU

An Editorial

2001: A Ham-Radio-in-Space Odyssey

Editor's note: This is the obligatory 2001editorial, mandated by popular culture to be written by anyone who came of age in the late 1960s, who is in any way connected with technology, and for whom the movie 2001: A Space Odyssey *was a defining moment in shaping a picture of the future. I'm certain that this will be only one of many you'll be seeing. — W2VU*

It's been a long journey... nearly a decade of planning, designing, building, testing, and ... waiting ... over three years of waiting. But now the long wait is over, and ham radio's newest super-satellite is in orbit. Phase 3D, as it's still known at this writing—the day after its November 15 launch—promises to usher in a new era in amateur radio space communications. And since most of its bandwidth is on microwave frequencies, it promises to usher in a new era of activity for those underutilized amateur bands. However, before we look too deeply into the future, let's take a look back in time, back to when *this was the future*.

The year was 1968. Man had not yet walked on the Moon. There were no personal computers, no Palm Pilots, no internet, no e-mail. Not even handheld calculators. But movie screens across America and around the world projected a vision of the future, a spacefaring future, as seen by Stanley Kubrick and Arthur C. Clarke. Their vision was set in "the future," not the distant future, but only a generation away—2001.

Looking back *from* 2001, it is amazing just how good Kubrick and Clarke's future vision really was. No, we're not sending manned missions to Jupiter and Saturn, but we have sent highly successful unmanned missions to both planets. No, we don't have colonies on the Moon, but what about their vision of spaceplanes ferrying passengers back and forth from Earth to an orbiting space station? We're not quite there yet, but we do have space shuttles ferrying crews back and forth to an orbiting space station. And what about the "Newspad," described as "a kind of flat portable TV device which can display any type of visual or printed material," on which the characters in the story received "radiofax" reports of the latest news from Earth? How different is that from your laptop with the wireless internet connection? Not very. In the fictional *2001*, 1968 arch-enemies US and USSR are on cordial speaking terms at the very least, cooperating in running an international space station. In the real 2001, there is no more USSR, but the US and Russia are on cordial speaking terms at the very least, cooperating in running an international space station.

Aboard the space station, Dr. Floyd takes a moment to call home from an orbiting payphone. According to Clarke's novelization of the movie script, *"Floyd, after checking that the Area Code for the United States was still 81, punched his twelve-digit home number, dropped his plastic all-purpose credit card into the pay slot, and was through in thirty seconds."* He left a message for his housekeeper on the answering machine. Now how different is that from picking up an inflight phone aboard virtually any commercial aircraft, swiping your credit card, and calling anyone anywhere? Oh, right, the US country code is 01, not 81.

Not even Clarke envisioned this one: Last month, while waiting for a plane in the Atlanta airport, my cell phone rang. It was someone at home in New Jersey, totally unaware I was anywhere outside the local area. It didn't matter where I was; the phone company computers could find me. And speaking of computers ... No look back at *2001* would be complete without remembering HAL, the neurotic supercomputer at the center of the story. I don't know about you, but neurotic would be a charitable word to describe every computer I've ever used. Pardon me while I politely ask mine to open the door to my CD drive so I can insert a new laser-scanned disc to keep me entertained while I write ("Open the pod bay door, Hal...").

OK, we're at the point where, in most of my editorials, you're usually asking, "but what does this have to do with amateur radio?" And I usually answer, "nothing ... and everything." Well, here we go again. What better way do we have of acknowledging *2001* than by validating Kubrick and Clarke's vision of us as a spacefaring people with not one, but two, ham-radio-in-space giant steps—the first amateur radio operation from the International Space Station, now dubbed Space Station Alpha, and the launch (finally) of the Phase 3D amateur satellite?

ARISS On the Air

High on the priority list of the first full-time crew of the Alpha space station was putting their ham station on the air. Not that any of the three crew members are such active hams, but the ham station provides their only personal, informal link with folks back on Earth. On November 13, less than two weeks after arriving at their orbiting "home," ARISS – Amateur Radio on the International Space Station was on the air. First contact—an engineering check—was with club station R3K at the Gagarin Cosmonaut Training Center in Star City near Moscow. This was followed by additional engineering test contacts with club stations NN1SS at the Goddard Space Flight Center in Maryland and W5RRR at the Johnson Space Center in Houston. There was no word at press time as to when the crew might kick back and enjoy a few "leisurely QSOs" (a.k.a. massive pile-ups) with hams here on the surface.

Phase 3D ... Finally in Orbit

When Phase 3C—later known as OSCAR-13—was launched in 1988, a few of us hams who happened to work for television networks (yours truly included) managed to pull some strings to get a satellite receiver tuned to the European Space Agency launch video and a technician to "roll tape" on the liftoff. In-home satellite TV receivers were a rarity, and about the only other way to see the launch was to go to South America and watch it live.

When Phase 3D finally lifted off on November 15, 2000, anyone with (a) a home satellite dish or (b) a reasonably fast internet connection and QuickTime software could watch and listen live as the Ariane 5 rocket blasted off. We at *CQ* ran a "special event" on our website, providing a link to the live video while Satellite Editor Phil Chien, KC4YER, filed minute-by-minute updates of launch progress, background, and interesting information about this long-awaited satellite launch (thank you, Phil, for your excellent effort). It was incredible to watch the video in one corner of my screen while watching Phil's latest posting pop up in another. In 12 short years we've developed an entirely new method of communicating news as it happens, and the best part is that it can be customized to individual needs. Yes, there were other "launch logs," but only ours had a ham radio focus. The ability to do something like this was mind-boggling, even in (nearly) 2001.

An interesting side-effect of our P3D launch coverage, which included a couple of updates to our e-mail newsletter list (one for the launch, the other for the final separation of the P3D satellite from the Ariane 5 booster), was that several people sent me e-mails asking to be removed from our newsletter list. "How do I stop getting e-mail from you?" one asked. Kinda made me wonder ... Why would you sign up for a ham radio news list if you don't want to be notified of ham radio news? Maybe satellites aren't your interest. But who knows what aspect of ham radio will be the subject of the next news event?

CC&Rs: Back to Square One

In fact, there was a third message on the CQ News list that night that had nothing to do with satellites; it seems that my fear, expressed in November's "Zero Bias," was well-founded. On November 13, the FCC turned down the ARRL's petition for reconsideration of its earlier refusal to extend the limited protections of partial federal pre-emption of antenna laws to so-called restrictive covenants, or CC&Rs. ARRL leadership had been working very hard behind the scenes to get a reversal of that first denial, and *CQ* even joined the effort with letters to each of the FCC commissioners. But the matter never even reached their desks. The door was slammed shut by the Deputy Chief of the Wireless Telecommunications Bureau, ironically a woman named Kathleen O'Brien Ham.

"Unlike over-the-air reception devices (OTARDs), which are very limited in size in residential areas," the ruling states in part, "amateur station antennas may vary widely in size and shape...Amateur station antennas, in order to achieve the particular objectives of the amateur radio operator, can be a whip attached to an automobile, mounted on a structure hundreds of feet in height, or a wire hundreds (or even more than a thousand) of feet in length. They can be constructed of various materials occupying completely an area the size of a typical backyard. In addition, there can be an array of different types of antennas. Regardless of the extent of our discretion with respect to

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SS-12	10	12	1⅜ x 6 x 9	3.4
SS-18	15	18	1⅜ x 6 x 9	3.6
SS-25	20	25	2⅛ x 7 x 9⅜	4.2
SS-30	25	30	3¼ x 7 x 9⅜	5.0

MODEL SS-25M

DESKTOP SWITCHING POWER SUPPLIES WITH VOLT AND AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SS-25M*	20	25	2⅛ x 7 x 9⅜	4.2
SS-30M*	25	30	3¼ x 7 x 9⅜	5.0

MODEL SRM-30

RACKMOUNT SWITCHING POWER SUPPLIES

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25	20	25	3½ x 19 x 9⅜	6.5
SRM-30	25	30	3½ x 19 x 9⅜	7.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M	20	25	3½ x 19 x 9⅜	6.5
SRM-30M	25	30	3½ x 19 x 9⅜	7.0

MODEL SRM-30M-2

2 ea SWITCHING POWER SUPPLIES ON ONE RACK PANEL

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30-2	25	30	3½ x 19 x 9⅜	11.0

WITH SEPARATE VOLT & AMP METERS

MODEL	CONT. (Amps)	ICS	SIZE (inches)	Wt.(lbs.)
SRM-25M-2	20	25	3½ x 19 x 9⅜	10.5
SRM-30M-2	25	30	3½ x 19 x 9⅜	11.0

MODEL SS-12SM/GTX

MODEL SS-10EFJ-98

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SS-10MG, SS-12MG
SS-101F, SS-121F
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SS-12TK OR SS-18TK
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SS-10SM/GTX, SS-12SM/GTX, SS-18SM/GTX
SS-10RA
SS-12RA
SS-18RA
SS-10SMU, SS-12SMU, SS-18SMU
SS-10V, SS-12V, SS-18V

CIRCLE 134 ON READER SERVICE CARD

*ICS – Intermittent Communication Service

CC&Rs generally, we are not persuaded by ARRL's arguments that it is appropriate at this time to consider exercising such discretion with respect to amateur station antenna preemption."

Ms. Ham's decision misses the point entirely. The backyard-size antenna she cites as an example is W5UN's "Mighty Big Antenna" featured on the cover of last September's *QST* magazine. The ARRL has never suggested that communities be required to permit installations the size of Dave's monster moonbounce array. Nor did PRB-1, the FCC's 1985 limited preemption ruling, impose such a requirement on municipalities. PRB-1, and its subsequent codification into Part 97 of the FCC Rules, simply requires "reasonable accommodation" of amateur communications, and that local rules represent "the minimum practicable regulation" needed to accomplish their goals. "(W)e believe that the PRB-1 ruling correctly reflects the Commission's preemption policy in the amateur radio context," writes Ms. Ham. The League never questioned that. It simply requested that the same rules that apply to municipal governments be applied to homeowner boards in "private communities" as well. Writing about backyard-size antennas merely obfuscates the real issue, which is never addressed.

One issue that was addressed, sort of, is what the FCC views as "reasonable accommodation" of amateur operation under PRB-1. We hope this clarifies any confusion that you, or your town zoning board, may be having over just what "reasonable accommodation" really means:

We do not believe that a zoning regulation that provides extreme or excessive prohibition of amateur communications could be deemed to be a reasonable accommodation. For example, we believe that a regulation that would restrict amateur communications using small dish antennas, antennas that do not present any safety or health hazard, or antennas that are similar to those normally permitted for viewing television, either locally or by satellite, is not a reasonable accommodation or the minimum practicable regulation. On the other hand, we recognize that a local community that wants to preserve residential areas as livable neighborhoods may adopt zoning regulations that forbid the construction and installation in a residential neighborhood of the type of antenna that is commonly and universally associated with those that one finds in a factory area or an industrialized complex. Although such a regulation could constrain amateur communications, we do not view it as failing to provide reasonable accommodation to amateur communications.

At the risk of appearing totally ignorant, just what is "the type of antenna that is commonly and universally associated with those that one finds in a factory area or an industrialized complex"? A cell tower? Broadcast antennas? VHF whips for intra-plant communications? I'm so glad we cleared up this confusion.

Finally, and perhaps more important, the decision is problematic for more than what it says. With all due respect to Ms. Ham, she is the author of the original denial of the ARRL's petition for rule making. One would think that a petition for reconsideration would not go right back to the person whose initial decision is being appealed. If you appeal a court case, it generally doesn't go back to the original judge. It goes up a level. FCC procedures should require that petitions for reconsideration be decided, at the very least, by someone higher up the bureaucratic ladder —the Chief of the WTB in this case —if not by the Commission itself.

What's next? The League could, and probably should, request a review by the full Commission. However, it seems to us at this point that the most logical place to go from here is straight to Congress. It's unlikely that amateur radio antenna problems will be of sufficient gravity to grab Congress's attention. On the other hand, amateur radio antenna problems are only a tiny symptom of a major problem that should be grabbing Congress's attention—the fact that millions of Americans are living in mini-dictatorships, under de facto governments that answer to no one, least of all Congress.

We have a new Congress and a new President taking office this month (although at this writing, we still don't know who that President will be). It is a perfect opportunity for each of us and all of us to start talking with our representatives in Congress about bringing homeowner boards and restrictive covenants under the rule of law, about declaring homeowner boards to be the equivalent of local governments, and requiring that they be subject to all laws and regulations that apply to local governments. This will not only bring the protections of PRB-1 to residents of these private communities, but will also bring them the protections of another, better-known document called the Constitution.

Lest I forget, Happy New Year, Happy New Century, and Happy Millennium. And don't forget Kids' Day on the radio on New Year's Day!

73, Rich, W2VU

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Announcements

• **Southeastern VHF Society Conference Call for Papers** – The SVHFS will host their 5th annual conference on April 20–21 at the Holiday Inn Brentwood in Nashville, Tennessee. They are calling for papers to be published in the conference Proceedings. Papers should be submitted to Dick Hanson, K5AND, 7540 Williamsburg Drive, Cumming, GA 30041 (phone 770-844-7002; fax 770-889-8297; e-mail <k5and @ga.prestige.net>) for review. Deadline for submission is February 20, 2001. Papers may be hardcopy, or preferably on diskette in MS Word 7 (or later) format (Word Perfect files can also be converted). Pictures are best in black and white. Guidelines details may be viewed on <www.svhfs.org/svhfs>.

• **Ham Radio University 2001** – The second annual HRU, a special day of education for amateur radio, will be held on Sunday, January 21, at the Babylon Town Hall Annex, Phelps Lane, North Babylon, Long Island, New York. Included will be forums on all aspects of ham radio, including licensing, purchasing equipment, packet and APRS, satellite, QRP, tower and antenna regulations, RF safety, QCWA, kit building, DXpeditions, and more. There also will be information booths for the participating clubs in the area, as well as ARRL, QCWA, a tune-up clinic, and DXCC WAS card checking, plus an exam session. Donation is $2.00; spouses and children under 12 free. For more information, e-mail Phil Lewis, N2MUN, <n2mun@optonline.net> or call 631-226-0698.

• **K1D Special Event** – K1MOM and W1DAD will present "K1D" for Kid's Day Ham Radio Awareness, Atkinson ARC, from 0500Z December 23, 2000 to 0500Z January 7, 2001. Kid's Day is January 6 from 1800–2400Z. For QSL send an SASE to Peter Schipelliti, W1DAD, 7 Dearborn Ridge Road, Atkinson, NH 03811 (<w1dad@arrl.net>).

• **The following hamfests, etc., are scheduled for January:**

Jan. 6, **West Allis RAC Midwinter Swapfest,** Waukesha County Expo Center Forum, Waukesha, Wisconsin. Contact Phil, W9NAW, 414-425-3649. (Exams)

Jan. 12–13, **Fort Myers ARC Hamfest,** Ft. Myers, Florida. Contact G. E. Sammons, WA4DQE, 3667 Kelly St., Ft. Myers, FL 33901 (941-936-9431; <wa4dqe@juno.com>). (Talk-in 147-345).

Jan. 13, **Central Arzona DX Assn. Annual Awards Banquet,** Sheraton Phoenix Airport Arizona Room, Tempe, Arizona. Contact CADXZA, 6545 E. Montgomery Rd., Cave Creek, AZ 85331 (623-580-0015; e-mail: <w8aef @arrl.net>).

Jan. 13, **Greenwood ARS Hamfest,** Greenwood Civic Center, Greenwood, South Carolina. Contact Frank Kolar, WA9FWO, 104 Rock Creek Drive, Greenwood, SC 29646 (864-229-5639). (Talk-in 147.165; exams)

Jan. 14, **South Bend Hamfest,** Elkhart County Fairgrounds, Goshen, Indiana. Call Denny, 219-291-0252 (7–10PM EST). (Talk-in 145.290)

Jan. 20, **Southeast Louisiana ARC Hamfest,** SE Louisiana University Center, Hammond, Louisiana. Contact SELARC, P.O. Box 1324, Hammond, LA 70404.

Jan. 20, **Gallatin Hamfest,** Gallatin Civic Center, Gallatin, Tennessee. Call 615-451-0213; <www.scara.net>; e-mail: <hamfest@scara.net>. (Talk-in 147.240+ and 444.350+; exams)

Jan. 21, **Richmond Frostfest 2001,** The Showplace, Richmond, Virginia. Contact Forstfest 2001, P.O. Box 14828, Richmond, VA 23221-0828 (804-739-2269 ext. FEST; <www.frostfest.com>). (Talk-in on 146.88; handicapped accessible)

Jan. 21, **Hazel Park ARC Swap & Shop,** Hazel Park High School, Hazel Park, Michigan. Contact HIPARC, P.O. Box 368, Hazel Park, MI 48030. (Talk-in 146.64–)

Jan. 27, **Lockport ARA Hamfest/ Auction,** Eagle's Hall, Lockport, New York. Contact Duane Robinson, W2DLR, P.O. Box 142, Ransomville, NY 14131 (716-791-4096); e-mail Bob Radmore, <N2PWP@arrl.net>; web: <http://lara.hamgate.net>. (Talk-in on 146.82)

Jan. 28, **Tusco ARC Hamfest,** Ohio National Guard Armory, Dover, Ohio. Contact Gary Green, KB8WFN, 32210 Norris Rd., Tippecanoe, OH 44699 (740-922-4454; e-mail: <kb8wfn@tusco.net>). (Talk-in 146.730–)

Jan. 28, **Wheaton Community Radio Amateurs Midwinter Hamfest,** Hawthorne Race Track, Cicero, Illinois. Contact WCRA, P.O. Box QSL, Wheaton, IL 60189 (<http://www. wheaton-hamfest.org>; e-mail: <info@ wheaton-hamfest.org>). Talk-in on 145.390; exams)

Jan. 28, **Maryland Mobileers ARC Swapfest,** Odenton Firehall, Odenton, Maryland. Contact Gary Johney, 410-437-4285; e-mail: <w3cu@arrl.net>. (Talk-in 146.805, PL107.2; exams)

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Amateur Satellites

Ham Radio in Space

BY PHILIP CHIEN, KC4YER

Phase 3D in Orbit—Introducing AMSAT-OSCAR 40

Editor's Note: The launch of AMSAT's Phase 3-D satellite came right at this issue's deadline. This brief summary will be followed next month by a full article about Phase 3-D's capabilities.

On November 16, 2000, at 1:07 AM UTC, the main engines of Ariane 507 ignited and about 45 minutes later Phase 3-D was ejected from the launch vehicle. It was the long-awaited launch of the most sophisticated, expensive, and capable amateur radio satellite ever developed.

The Phase 3-D project was started in 1991 by hams in Germany and the United States. Eventually 15 countries became involved in the multi-national project. Initially, Phase 3-D was supposed to launch on the second test flight of the Ariane 5 launch vehicle in 1996. However, delays to the Ariane 5 program and the Phase 3-D project resulted in a four-year slip to the planned launch.

Components were built around the world and shipped to Orlando, Florida where a team of paid engineers and volunteers assembled and tested the satellite from 1994 to 1999. On January 16, 2000 Phase 3-D left Florida for shipment to the French Guiana launch site.

Phase 3-D's sister passengers for its flight to orbit were Panamsat's PAS-1R, the largest commercial communications satellite ever built, and the small Space Technology Research Vehicle (STRV) 1-c and 1-D microsats. All together the Ariane 5 lofted a total payload mass of 6313 kgs. in to geostationary transfer orbit.

All of the previous Phase 3 satellites flew on Ariane launch vehicles. Of the series, Phase 3-B (AO-10) and 3-C (AO-13) made it to orbit successfully and AO-10 remains in limited operation.

Monitoring Launch Progress

As with most previous ham radio satellite launches, HF nets were set up to inform hams about the status. But improvements in communications technology made it possible to follow the launch in much more detail. Some hams watched the launch directly via commercial satellite broadcasts. Others watched or listened to internet webcasts or audio broadcasts. *CQ* had an exclusive ham radio launch journal describing each major step of the countdown and launch.

Peter Guelzow, DB2OS, was the Phase 3-D team's representative in Arianespace's Jupiter control center. He monitored Phase 3-D's health before launch and informed the Arianespace launch team that Phase 3-D was go for launch. Afterwards he said, "It was a textbook launch from the first minute of flight, until P3D separated from the Ariane 5 launch vehicle. All received telemetry indicates the launch went perfectly and our satellite appears to be in very good health."

Within a couple of hours, reception reports of the 2 meter 145.898 MHz low-power beacon were coming in from hams around the world. Amazingly, many also were able to detect the signal on handheld 2 meter radios with rubber-duck antennas! The next day it was officially announced that Phase 3-D was given the on-orbit designation of AMSAT-OSCAR 40, or AO-40. It's traditional for satellites to have project designations while they're being manufactured and serial numbers after they're successfully activated on-orbit.

Phase 3-D also has the German call sign DPØWH, in memory of Werner Haas, DJ5KQ, one of the key engineers responsible for Phase 3-D. Werner unfortunately died before Phase 3-D's launch and the team decided to choose the call-sign DPØWH in his memory.

Ariane 507, with the AMSAT Phase 3D satellite safely tucked away inside, awaits its November 16, 2000 launch. See this issue's cover for a photo of the launch itself. (Photo courtesy Arianespace)

What's Next?

It will take several months until AO-40 reaches its final orbit. During the transfer orbits most of AO-40's power will be used to charge the batteries to operate the arcjet engine, so AO-40 will only be made available for general ham radio communications for a small period of time. Hams will require fairly sophisticated ground stations, similar to the ones used for AO-13.

After AO-40 reaches its operational orbit, there will be major improvements. The solar arrays will be opened up, increasing power generation from 200 watts up to 600 watts. The satellite will be despun with the high-gain directional antennas aimed directly towards the Earth. This will be a significant improvement in Phase 3-D's performance, reducing the requirements for ground stations.

There's no doubt this is an exciting time for amateur radio!

—73, Phil, KC4YER

Web Links

Here are some sources of additional information on Phase 3-D (AO-40) and the Ariane 507 launch:

Quicktime movie of the Ariane V135 launch:<http://arianespace.com/interior/v135better.mov>

One ham's reception of the Phase 3-D signal:<http://www.ne.jp/asahi/hamradio/je9pel/ fft_disp.htm>

AO-40 Keplerian elements: <http://www.amsat.org/amsat/keps/ao40.html>

Specs for the Panamsat 1-R primary payload: <http://www.panamsat.com/sat/p1rinfo.htm>

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We're adding a new "wing" to our CQ Hall of Fame for outstanding hams. Starting this year, in addition to the CQ Contest Hall of Fame and the CQ DX Hall of Fame, we'll also have the CQ Amateur Radio Hall of Fame.

Announcing:

The *CQ* Amateur Radio Hall of Fame

Rodney Dangerfield would probably feel right at home among hams. It sometimes seems that hams and ham radio just don't get the proper respect and recognition for the many advances in communications technology for which we've been responsible, for the entire industries that have been built on the foundation of amateur radio experimentation and activity. Why not? Perhaps one reason is that we hams ourselves haven't done a very good job of recognizing our most outstanding colleagues.

In an effort to help change that, and hopefully to start opening the public's eyes to the far-reaching and long-standing value of amateur radio in our society, *CQ* is proud to announce the establishment of the *CQ* Amateur Radio Hall of Fame.

"The new Amateur Radio Hall of Fame will honor those whose technical or other accomplishments have helped propel amateur radio forward, or whose achievements in other areas of life have helped improve ham radio's reputation simply through association."

CQ is already a leader in this field, recognizing significant achievements in contesting and DXing in our Contest Hall of Fame and DX Hall of Fame. The new Amateur Radio Hall of Fame will honor those whose technical or other accomplishments have helped propel amateur radio forward, or whose achievements in other areas of life have helped improve ham radio's reputation simply through association.

Nominees for the *CQ* Amateur Radio Hall of Fame will be judged on the basis of qualifying in one of two broad areas: those individuals, whether licensed amateurs or not, who have made significant contributions to the amateur radio hobby; and those radio amateurs who have made significant contributions to society in general.

A prime example of a non-amateur who might qualify would be Edwin Howard Armstrong, who began his career in radio on the ham bands before there were licenses, and who built the technical foundation on which all of amateur radio is based (not to mention all other wireless telecommunications) by inventing the super-regenerative receiver, the superheterodyne receiver, the continuous wave oscillator, and FM.

An excellent candidate for contributions to society by a radio amateur would be Dr. Grote Reber, who, as W9GFZ, used his ham radio knowledge to build the world's first radiotelescope and establish a new branch of basic science.

Finally, there are those few who might qualify under both criteria, such as the late JY1, King Hussein of Jordan. His presence on the airwaves lent his immense personal dignity to the hobby, and in his role as a world leader, he helped to bring a little more peace and a little less bloodshed to the Middle East.

The Envelope, Please...

Between now and March 31, 2001 we will be accepting nominations for the inaugural "class" of the Amateur Radio Hall of Fame. Nominations received after that date will be considered for future selection. You may either use the form on the following pages or on our website, or simply write us a letter stating your candidate's name, where to contact him/her if still living, for which category you are nominating him/her, and a brief one to two paragraph description of this person's accomplishments. Please include your name and contact information as well. E-mail to <hall-of-fame@cq-amateur-radio. com> or mail to *CQ* Amateur Radio Hall of Fame, 25 Newbridge Rd., Hicksville, NY 11801.

"Please help us recognize these "ham radio heroes" whose contributions have helped shape our hobby, our nation, or our world. "

We'll be making up our own candidate list at the same time, and will announce our initial selections at the Dayton Hamvention in May 2001. Please help us recognize these "ham radio heroes" whose contributions have helped shape our hobby, our nation, or our world.

(On the reverse side is the form that must be completed and sent in.)

CQ Amateur Radio Hall of Fame Nomination Form

The purpose of the CQ Amateur Radio Hall of Fame is to recognize individuals who have made significant contributions to the amateur radio hobby, and/or radio amateurs who have made significant contributions to society at large.

Name of Person Nominated:_____

Callsign (if licensed amateur/if multiple callsigns, list most recent): _____

If your nominee is still living and you know how to contact him/her, please supply the following contact information:

Mailing address: _____

City: _____ State/Prov._____ Zip/Postal Code:_____

Country: _____

Phone: _____ Fax: _____

E-mail address:_____ @ _____

Please write a brief (one to two paragraph) description of this person's accomplishments/achievements and why you feel he/she should be elected to the CQ Amateur Radio Hall of Fame (if you need more room please attach a separate piece of paper):

Nominator Information

(This is only for the purpose of contacting you in case of questions, and will not be published.):

Your name: _____ Callsign: _____

Mailing address: _____

City: _____ State/Prov._____ Zip/Postal Code:_____

Country: _____Phone: _____Fax: _____

E-mail address:_____ @ _____

Here's a once-in-a-thousand years opportunity to have fun on the air and get some cool "wallpaper" as a bonus ... without having to wait for QSL cards.

Announcing:

The CQ Millennium Award

Happy new year! Happy new century! Happy new millennium! The debate is over. Once all of us make it into 2001, there will be no question that we've entered the third millennium on the Gregorian calendar. Now that we're all in agreement on which millennium and which century we're in, and now that we've got a whole bunch of new operators on the HF ham bands who are eager to work DX and hang up some operating awards, or "wallpaper," we at *CQ* decided it was finally time for us to sponsor an official millennium operating award. Rather than coming up with a whole new award with a whole new set of rules, though, we decided to make it simple (but challenging), while helping you qualify for our all-the-time award programs.

Here's how it works: During calendar year 2001 (UTC), meet the minimum qualifications for the basic level of any one of our other awards (minus the QSL cards), and you're in. For example, work stations in 500 counties—the basic level for the USA-CA Award—send us your log extract in accordance with USA-CA rules, and you qualify for the CQ Millennium Award. The same goes for the basic levels of the CQ DX Award (100 countries), the Worked All Zones Award (work one station in each of the 40 CQ zones), and the CQ WPX Award (work 400 prefixes mixed mode or 300 prefixes single mode—CW or SSB only). Work 'em, send us your log extract showing the information required by the standard award rules, in the format required by the standard award rules, plus a $6 processing fee ($12 outside the US) and that's it.

There will be special recognition if you qualify on the basis of more than one award program's requirements, particularly if you achieve the nearly impossible feat of contacting 500 counties, 400/300 prefixes, 100 countries, and 40 zones in the course of a single year.

Because this is an operating award rather than a contest, there are no band restrictions on qualifying contacts (even if a particular award *does* have band restrictions in its standard rules). The award is open to all amateurs—VHFers probably have the best chance of qualifying under WPX rules—and to SWLs, even for those awards that do not normally have SWL components.

The operating period for the CQ Millennium Award is 0000 UTC on January 1, 2001 to 2359 UTC on December 31, 2001. (It was tempting to make it from 01:01:01 on 01/01/01 to 12:31:01 on 12/31/01, but it wouldn't work in Europe, where it would end on 31/12/01, and we haven't been able to find a matching time.) Final log submissions must be made by March 31, 2002. Please refer to standard award rules on the *CQ* website (<http://www.cq-amateur-radio.com>) for specifics on the requirements for each award. Details regarding log submissions and certificates will follow in a subsequent issue. For now, though, start working those stations and start collecting your choice of counties, countries, prefixes, or zones—or all four!

Remember, an opportunity like this won't come along again for another 1000 years! ■

One of ham radio's "big three" establishes an east-coast presence along with its own, communications-focused identity.

Kenwood Connects in Atlanta

BY RICH MOSESON,* W2VU
Editor, *CQ*

If you've ever traveled by air in the southeastern United States, you know that it's practically impossible to get anywhere without making a connection in Atlanta (In fact, there's an old story in the south that you can't even go to Heaven without making a connection in Atlanta!).

Kenwood Communications Corp. has made a different sort of Atlanta connection, opening a new US headquarters there last June. Moving to the Atlanta suburb of Suwanee from Kenwood's main US headquarters in Long Beach, California were the company's research & development and sales & marketing staffs. A separate corporate entity from Kenwood's audio and service divisions, the communications group sells two-way radios for the Amateur, Land-Mobile, Family Radio, and General Mobile Radio Services, including so-called "color-dot" radios for the VHF frequencies just reallocated by the FCC to the new Multi-Use Radio Service (MURS). In recent years, Kenwood has risen to the number two position worldwide (behind Motorola) in terms of land-mobile radio sales. Until the move, the communications group shared space with Kenwood's audio division in Long Beach.

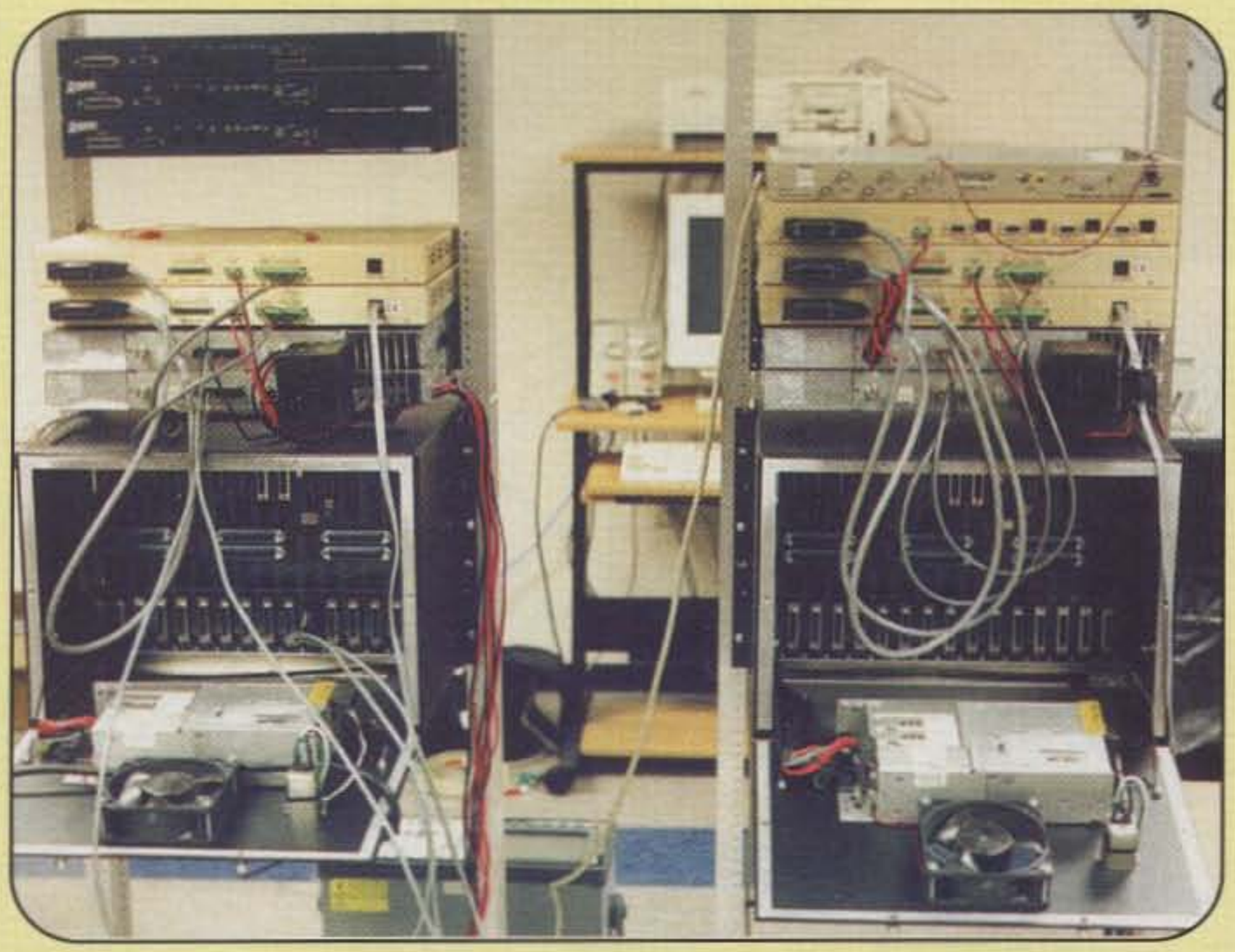
Once the ribbon was cut, it was time for the Japanese grand-opening tradition, known as "kagami wori." Kenwood officials Mori Tumora, Tom Wineland, and Bruce Tatsuta share the work of swinging the mallet to break open a cask of sake, Japanese rice wine, which was then served to the guests.

Part one of the bi-cultural grand opening of Kenwood Communications Corporation's new headquarters outside Atlanta, Georgia. Here Mori Tumora, Kenwood's Executive Director of International Marketing (center), cuts the ceremonial ribbon held by Kenwood America's President Bruce Tatsuta (left) and Kenwood Communications President Tom Wineland (right). (W2VU photos)

The new headquarters "creates a new synergy for the whole (communications) corporation," said Amateur Radio National Sales Manager Paul Middleton, KD6NUH, at the grand opening of the Atlanta facility in October. "Before, we had to try to fit in with the corporate culture of the audio division (which has a totally different clientele). ... This gives us the ability to take our core people and create our own identity." Kenwood's amateur radio warehouse and its customer service staff remain in California.

The grand opening combined elements of American and Japanese business opening traditions, with a ribbon-cutting ceremony, followed by "kagami wori," a ceremonial breaking of a cask of sake. Unlike the western tradition of smashing a bottle of champagne against the hull of a newly-commissioned ship, in which the champagne ends up on the ground

Down to business—the research & development lab in Kenwood's new Atlanta headquarters. No, that's not a misprint on the box. The TK-790 is a model number of a Kenwood land-mobile radio.



A pair of rack-mounted land-mobile repeaters under test in the Kenwood lab. The facility has been up and running since last June.

Paul Middleton, KD6NUH, Kenwood's Amateur Radio National Sales Manager, and CQ Publisher Dick Ross, K2MGA, watch the ceremonies during the grand opening.

or in the water, only the top of the sake cask is broken and cups of the Japanese rice wine are distributed to all guests. Guests at the Kenwood opening—who included amateur and land-mobile dealers, along with distributors from throughout Latin America—were also treated to a multicultural lunch, featuring Sushi as well as dishes with a distinct Georgia flavor such as Grilled Savannah Shrimp and grilled chicken strips with peanut dipping sauce.

For the *CQ* contingent, Publisher Dick Ross, K2MGA; Ad Manager Jon Kummer, WB2OJK; and Editor Rich Moseson, W2VU, it was a chance to be "jet setters" for a day, flying from New York to Atlanta in the morning, attending the grand opening, then returning to the airport and flying back to New York in time for a late dinner! ■

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A Coaxial Inverted-L Antenna For Topband

BY DR. THEODORE J. (TED) COHEN,* N4XX

Given the wavelengths involved, installing an effective transmit antenna for the 160 meter band is no trivial matter. The antenna discussed here was first described by Coleman Rollman, W4TWW, in the August 1984 issue of CQ magazine. We thought we'd let Ted Cohen, N4XX, present a somewhat different view of what he has found to be a fantastic performer on Topband, and show you how he squeezed it into his one-third acre suburban lot. — W2VU

Among the many goals one could set in amateur radio today, working DX on the 160 meter band certainly would be one of the more difficult to achieve! Challenges abound, resulting not only from the propagation observed (*see, for example, the article on Topband propagation by Ted and Cary Oler that was published in the March and April 1998 issues of CQ [Note 1 below].—ed.*), but also from the need for large transmit and receive antennas. Living in an urban or suburban area makes "working" the band even more difficult, but there are solutions that can provide some surprising results. Suffice it to say that the coaxial inverted-L antenna described here yielded 100 countries—worked *and* confirmed—plus WAS (Worked All States) during the Topband season that extended from September 1, 1996 through March 31, 1997.

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Antenna Design

The antenna, shown in fig. 1, is a 124 ft. coaxial, inverted-L. It bends at about the 70 foot level (thanks to a big black oak!) and runs to the 80 ft. level (thanks to a big white oak!). It then drops 10 feet or so; the end is tied to a fence using a slack nylon line. The antenna is made entirely of RG-8X, and it is shorted at the 104 ft. point (based on the velocity factor for this coax) as well as at the end. *The feed is inverted at the base, so the outer conductor of the coax antenna becomes the radiator* (see fig. 1).

I installed six 125 ft. and five 62.5 ft. (12 AWG, insulated) radials, bending

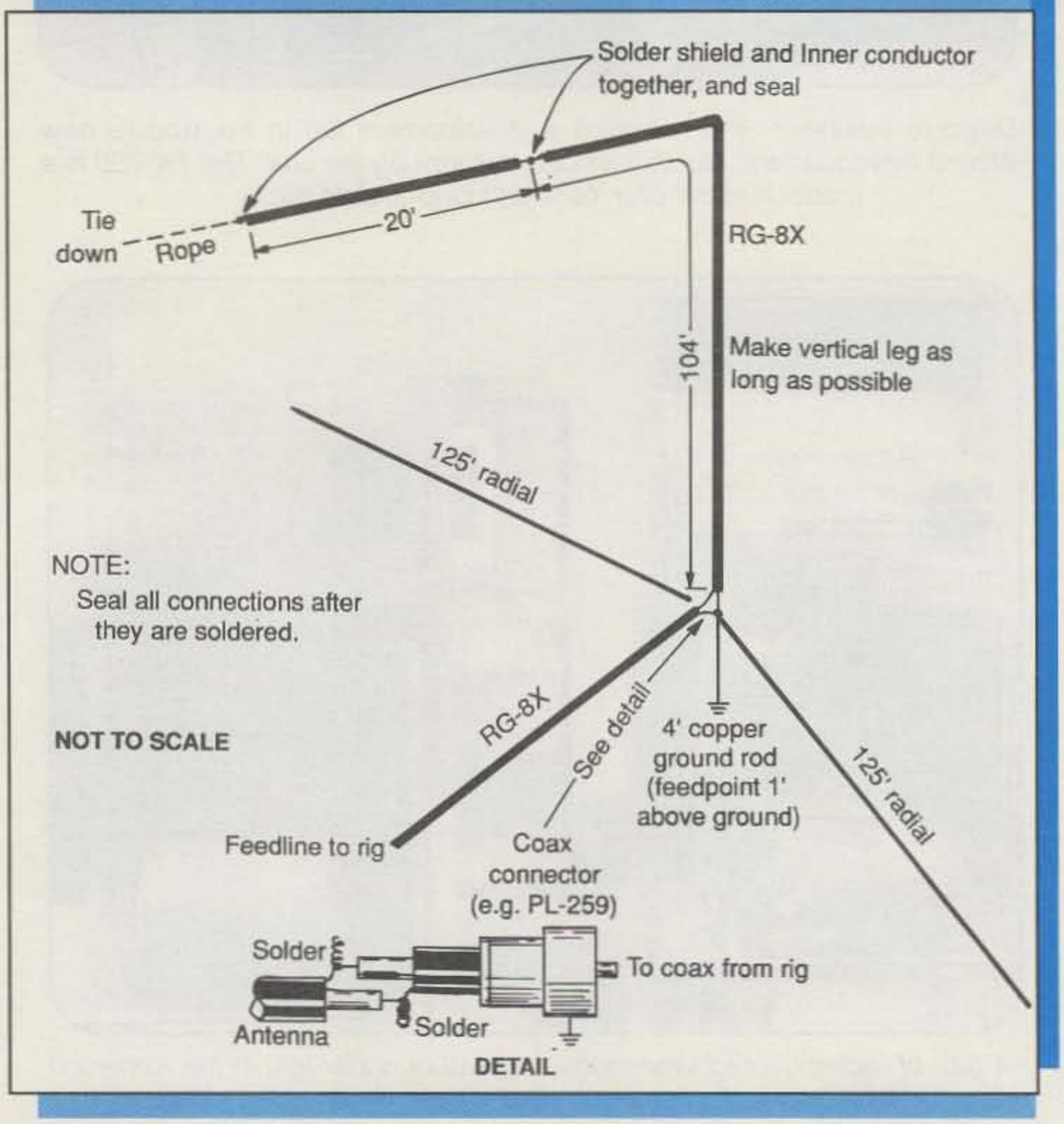

Fig. 1– A key step in constructing the Coaxial Inverted-L antenna is to invert the inner conductor and the braid of the coax at the feedpoint.

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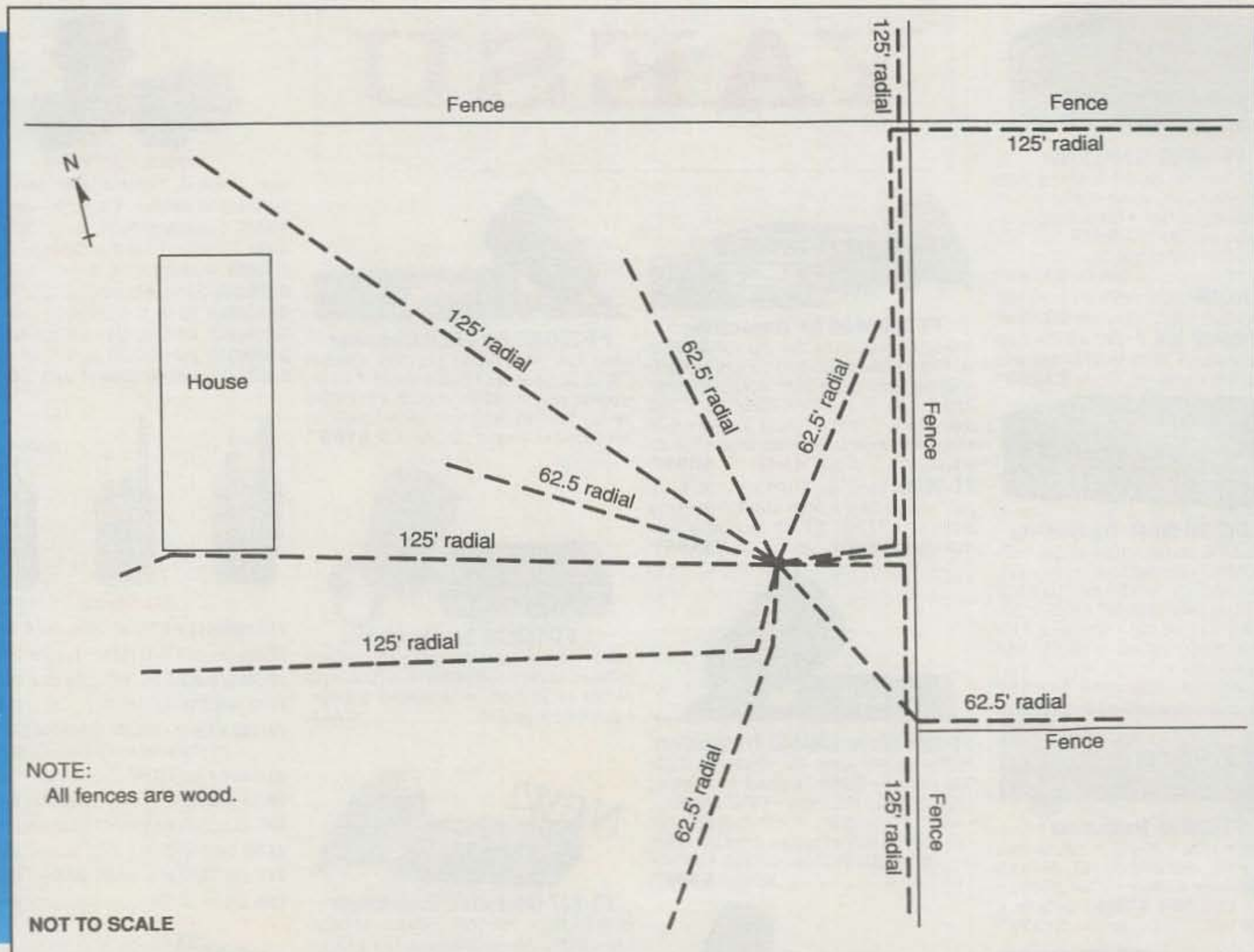

Fig. 2– The radial pattern of the 160 meter inverted-L at N4XX. What is important is to lay out as many radials as possible, so a large number of short radials is better than a few long ones.

them, as necessary, to go around trees and other obstacles (see fig. 2). Some of the radials are buried at a depth of 4 inches, while others run along my neighbors' fence lines. They are dispersed in azimuth as uniformly as was possible, but one could hardly call the pattern "ideal." Note, in particular, the paucity of radials to the east, toward North Africa. At the feedpoint, the antenna is tied to a 4 ft. RadioShack ground rod, which basically serves as a tie-down for the antenna and its radials. I used bungee cord (with a loop of coax) to take the strain off the antenna and to let it ride up and down as the wind moves the tree limbs. This is a better solution than using a weight and a pulley at the end of the antenna, given the number of children in the neighborhood and the attendant need to keep such a weight high off the ground.

The SWR is about 1.3:1 at 1830 kHz. It was higher before the full complement of radials was installed. I simply added radials until the SWR was sufficiently low as to provide tuner-free operation. With a good radial system, neither inductors nor capacitors, nor a tuner, should be required to tune the antenna.

How It Works

The antenna is one-half of a coaxial dipole (also referred to as a "double bazooka"). This antenna is recognized for providing a good impedance match over a wide range of frequencies *for its band of operation*. (Note: This is a single-band antenna.) According to Morris Lundberg, K4KEF, it was designed by the staff of the Massachusetts Institute of Technology (MIT) during WW II for radar applications (see <http://pacnet.ne.mediaone.net/resources/bazooka.txt> for more information). The outer shield of the antenna operates as a quarter-wave vertical. The inner conductor, which does not radiate, acts as a quarter-wave shorted stub. As such, it presents a high resistive impedance to the feed point at resonance. Off resonance, according to Lundberg, the stub reactance changes in a way that increases the bandwidth of the antenna. The shorted length of coax (or other conductor) beyond the short near the end of the antenna acts as a thick extension of the radiating element, which also acts to increase the bandwidth.

On-the-Air Results

The first contact with the new antenna was with John, ON4UN. For the conditions that existed at the time, the 500 W signal from the inverted-L was 10 dB stronger than was the signal from a six-band (160–10 meter) trap dipole that I had installed at the 40–45 ft. level (also in the trees). This contact was followed by QSOs with ON9CIB, CT1DVV, SM5EDX, C6A/N4RP, KP2/KW8N, and P40W, all worked on CW (the mode of choice on Topband!) and on the first or

second call. As noted above, the inverted-L, which serves as both my transmit and receive antenna, quickly netted 100 countries, worked and confirmed. And while Topband conditions over the past two seasons have been relatively poor, my DX totals today stand at 154 countries and 30 zones—and all thanks to the great performance of the coaxial inverted-L.

Other Considerations

Where the inverted-L antenna is shorted depends on the type of coax you are using. For example, if I had used RG-8, with a velocity factor of .66, the short would have been (roughly) at the 88 ft. point, although the total length of the antenna would have remained at 124 ft. You can use any type of wire beyond the short, including twin-lead (shorted at both ends and tied to both the inner conductor and outer shield at the end of the coaxial antenna line), wire, coax (shorted at the end), and so forth. You do need to install at least one or two quarter-wave radials. The more radials you can put out, the better. Thus, for example, it is better to put out ten short (e.g., 1/8-wavelength) radials than two 1/4-wavelength radials. (See notes below if you are considering the possibility of erecting an antenna of this type).

Conclusions

Working Topband is a challenge! Propagation, in many ways, is unlike anything you will experience on the 80–10 meter bands, antennas are necessarily large (long), and competition for DX QSOs grows with each passing year. When all is said and done, however, achieving DXCC and/or the lowest rung on the WAZ ladder (30 zones) on this band is viewed by many as being among the most rewarding achievements of their amateur careers.

Bibliography

1. Oler, C. and T. Cohen, "The 160 Meter Band—An Enigma Shrouded in a Mystery," *CQ*, March (Part I) and April (Part II) 1998 (readers may access this article on-line through the web site of the Solar Terrestrial Dispatch: <http://www.spacew.com/cq/html> or click on the html link within <http://www.spacew.com/cq>).

2. The total antenna length in feet is given by 230/F (F is in MHz). Thus, for an operating frequency of 1.85 MHz, the length is ~124 ft.

3. The total coax length required in feet (to the point where the antenna is shorted or another type of wire is used) for a velocity factor of 0.66 (RG-8) is given by 162.5/F (MHz). This is ~ 88 ft. at 1850 kHz. It is at this length (height) that the coax should be shorted. It also should be shorted at the 124 ft. point (the tip of the antenna). If desired, other wire can be used beyond the 88-ft. point to bring the total length of the antenna to 124 ft.

4. RG-8X has a velocity factor of 0.78. Using this type of coax, the antenna should still be 124 ft. long, but it should be shorted at the 104 ft. point. (For RG-8X, the coax length in feet (base to short) is given by [(492)/2]*0.78}/F, where F is in MHz.)

5. Inverted-L antennas for other bands are, of course, fashioned in the same manner.

Acknowledgements

Thank you to George Coyne, N1BV/4, who kindly lent his considerable skills as an archer to install this antenna (and others) in my trees. ■

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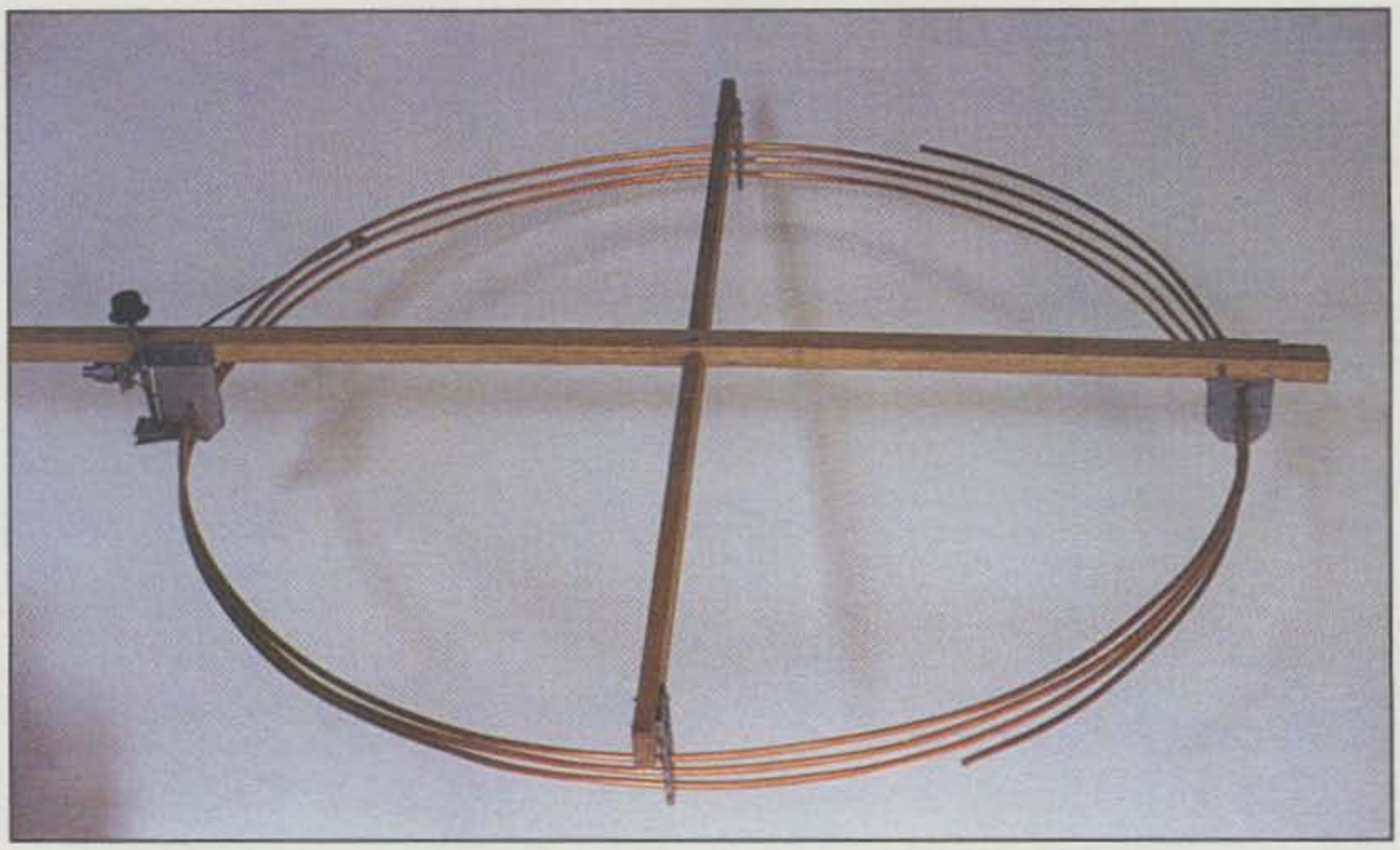
If a single-turn loop antenna is good, are multi-turn loops better? W6HPH says yes, both in theory and in practice. Plus, it can get you on the air on HF from antenna-limited locations.

Multi-Turn Loop Antennas

BY FRED BROWN,* W6HPH



The author's three-turn loop antenna for 40 meters is only 3 feet in diameter, making it ideal for someone operating in limited space.

Transmitting loop antennas have been around for a long time, but they are usually just one-turn affairs. According to Kraus[1], the *radiation resistance* of a loop antenna is proportional to the *square* of the number of turns, whereas the *conductor resistance* is simply proportional to the number of turns.

A three-turn loop, therefore, should have three times the efficiency of a single turn. I constructed an experimental 40 meter model to see what performance can be expected from a three-turn, 3 foot diameter loop.

The principle of the loop antenna can be understood by referring to fig. 1. The loop inductance resonates with the capacitor to the operating frequency; there will always be some point at a distance X from the center where a tap can be placed which will provide a match to 50 ohms. Increasing X will, of course, increase the feed impedance. Therefore, it is very easy to achieve a 1:1 SWR with a loop of any size at its resonant frequency. Usually, however, the loop will need retuning for even a QSY of only a few kHz.

Neglecting the capacitor loss, the radiation *efficiency* will be the ratio of the radiation resistance to the RF conductor resistance and normally will be quite small. The radiation resistance is proportional to the *fourth* power of the loop diameter, whereas the conductor resistance is simply proportional to the diameter. Therefore, doubling the diameter will raise the efficiency eight-fold.

Originally, this antenna was three turns with a tuning capacitor at the top. The capacitor is a split-stator type, because in this way the loss resistance of a wiping contact can be avoided. Even with a wide-spaced capacitor, however, there was flashover at a power level of only 10 watts. Accordingly, I built my own capacitor and placed it across two turns at the *bottom* of the loop. I considered a high-voltage fixed capacitor at the top, but decided it would be better to just extend the tubing to re-establish resonance. Thus, the loop ended up with a total of 3.36 turns, or 380 inches total conductor length.

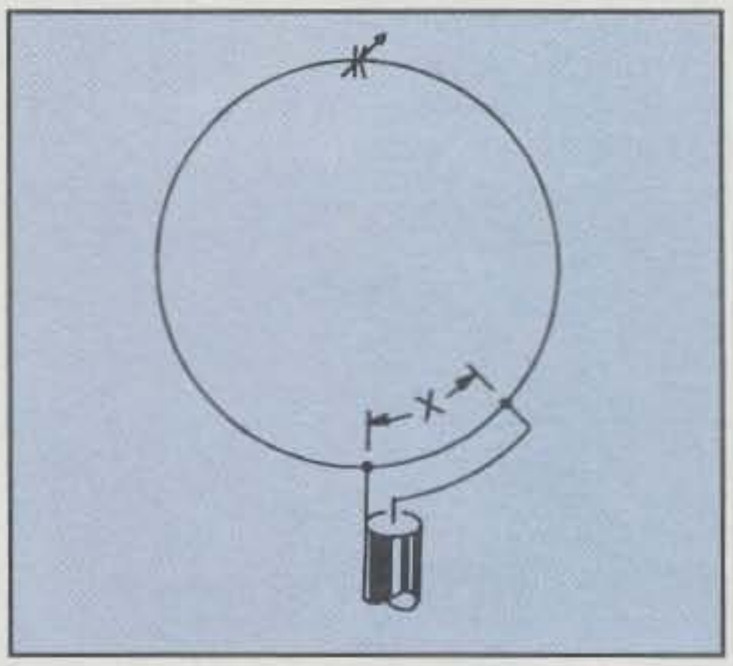


Fig. 1– Fifty ohm coax can always be gamma matched to a resonant loop as shown here.

Construction details should be clear from fig. 2 and the photo. The loop is made from standard 1/4 inch copper tub-

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ing readily available from building supply stores. The copper tubing is held by fiberglass supports on a hardwood frame. The "flapper" capacitor plates are cut from flashing copper and covered with Teflon™ tape. This is not the kind of Teflon tape used by plumbers; it is 5 mils thick and sticky on one side, like Scotch™ tape. It should be bent over the edge of the flashing copper and stuck to the outside of the plate so as to reduce the possibility of flashover.

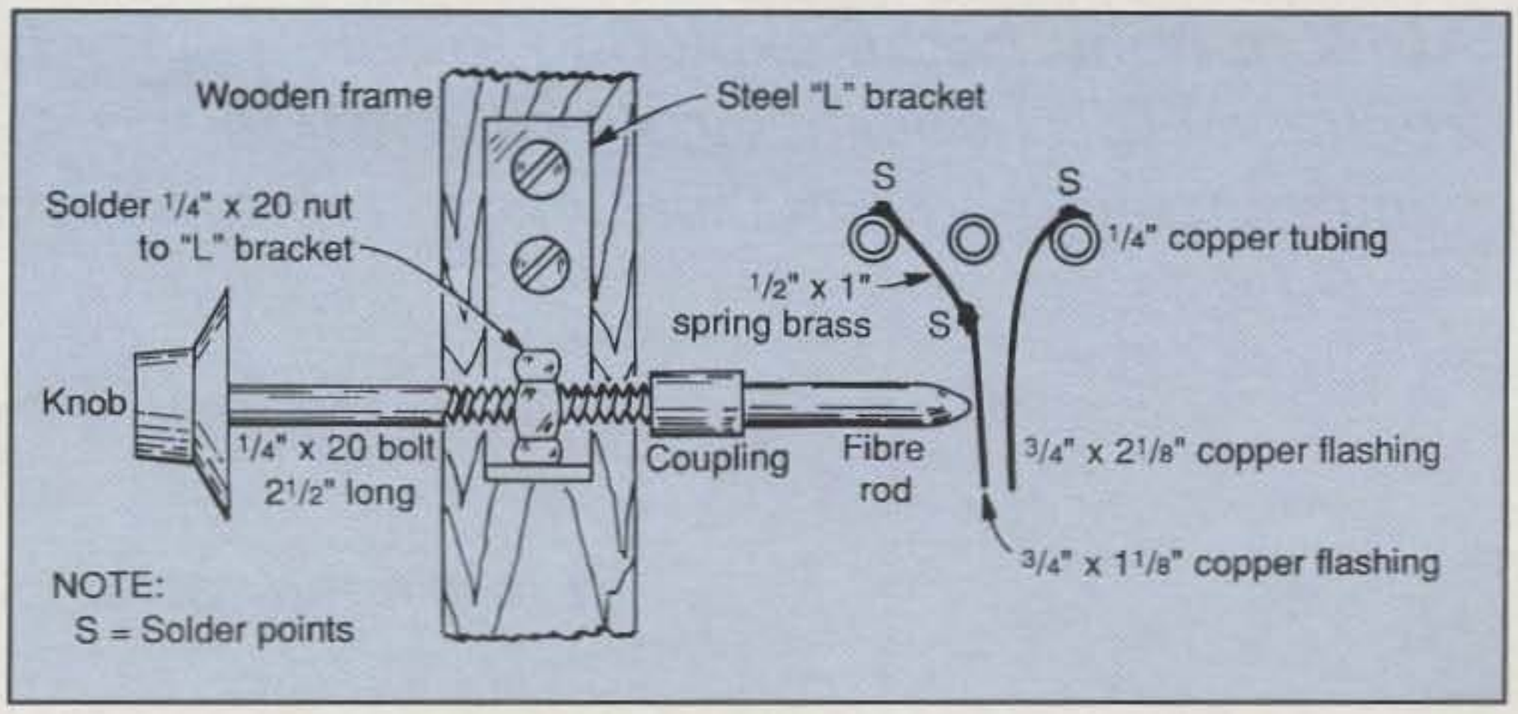

Fig. 2– Construction details of the flapper capacitor. The coax fitting (not shown) is connected to the middle turn of the loop. The outer conductor is connected to the center as in fig. 1, and the distance X is 12 1/2 inches for a match to 50 ohms.

Results

On-the-air tests show that with 100 watts PEP, the loop easily can work stations within the usual 400-mile range of daylight operation on 40 meters. A more quantitative test was made by comparing the loop with a full-wave doublet at 40 feet. This comparison showed the loop to be consistently 10 dB inferior to the doublet, both receiving and transmitting. However, since the loop was only 8 feet above the ground, at least some of that 10 dB can be accounted for by the difference in height. SWR bandwidth (below 2:1) is only 10 kHz, indicating a Q of 550. Still, it can be an attractive option for someone who is unable to put up a full-size antenna for 40 meters.

Calculations show the loop should be only 2% efficient. The actual performance substantially surpasses this figure, which I attribute to the non-uniform current distribution on the loop. The theory is based on the assumption of uniform current.

To understand this, remember that currents on diametrically opposite sides of the loop flow in opposite directions. Radiation from these two currents would cancel completely if it were not for the small spatial separation. This is the reason for the low radiation resistance of the loop antenna.

If the two currents are not exactly equal, however, cancellation will be incomplete and radiation resistance therefore will be enhanced. Since the loop has a total conductor length that is an appreciable fraction of a wavelength (actually 0.23 wavelength), a non-uniform current distribution can be assumed. For instance, current at the conductor ends obviously must be zero.

Don't be surprised if you see a commercial version of this antenna come onto the market. Just remember you saw it first in *CQ*! ■

Reference

1. Kraus, *Antennas, First Ed.*, McGraw-Hill, page 167.

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Cave Radio in Britain

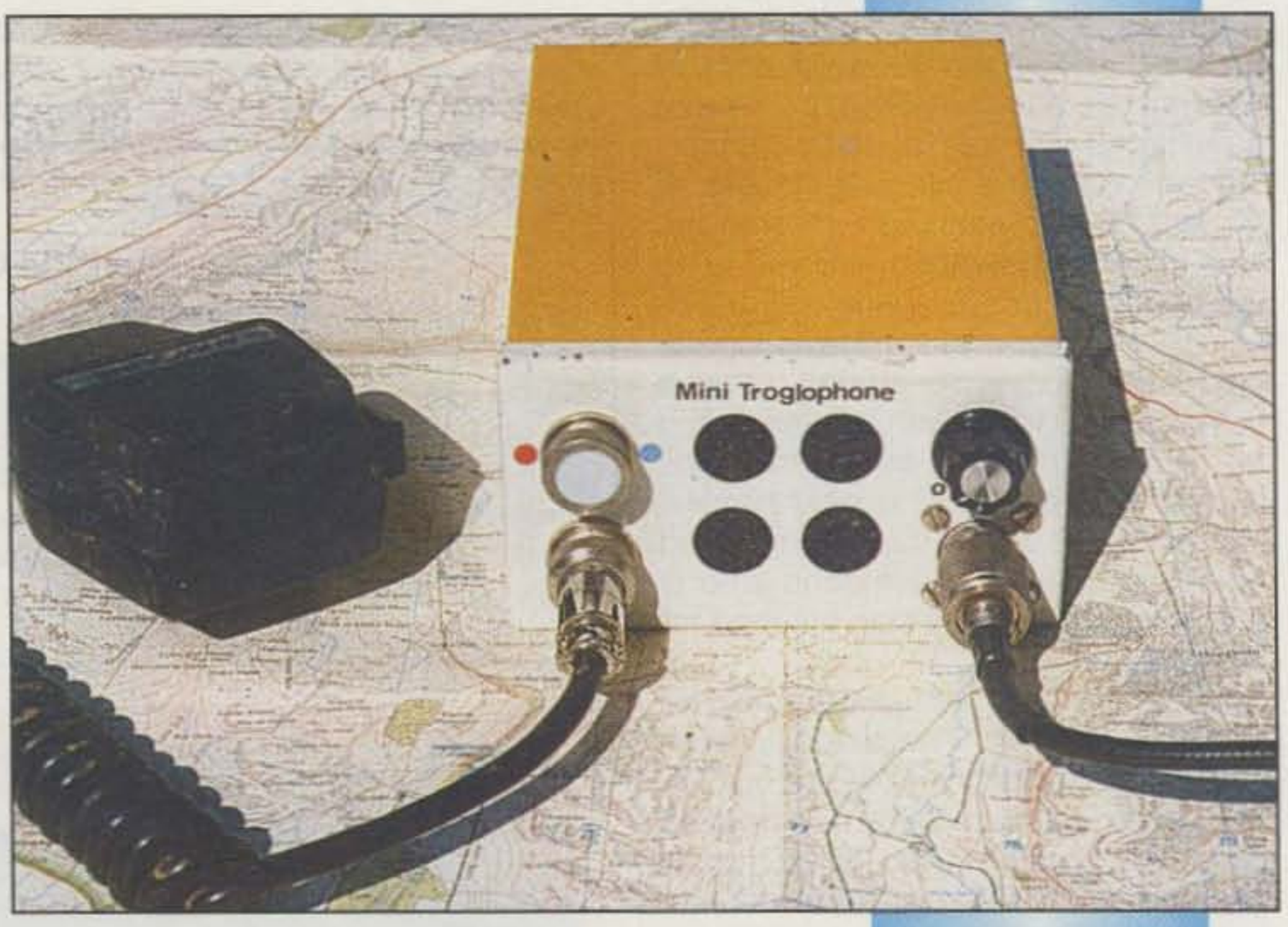
BY JOHN R. HEY,* G3TDZ

Communicating through rock is a challenge unlike some of the other branches of amateur radio endeavor. It may not actually *be* amateur radio; technically, it isn't even *radio,* because the signals don't travel through the air. However, nearly all of the members of the Cave Radio and Electronics Group (CREG) who gather a few times a year to carry out experiments are radio amateurs, and what we do unquestionably involves amateur radio skills.

Not everyone is involved with voice communication, as we branch out into photography, cave counters, water level monitoring, location beacons, and alternative lighting systems. Recently we successfully transmitted slow scan TV to the surface from Yordas Cave and from Kingsdale Master Cave using the Kenwood VC-H1 module connected to our cave radios.

The radios we now use are the latest in a line of development, each using the phasing method of SSB generation and reception at a frequency of 87 kHz USB. My involvement began six years ago, when I first became interested in LF communication. As an experimenter, my goal was to try out CMOS (Complementary Metal Oxide Semiconductor) switches as mixers and to replace tuned circuits with active filters. But to what purpose? There was no amateur LF allocation in Britain at the time.[1] Maybe there was a cave radio, but I had never been in a cave in my life. A chance QSO on 80 meters decided things: "Did I not know of CREG?" I was asked.

Invited to meet "the gang," I was introduced to caving at the age of 60 and encouraged to try out my ideas. Loaned a pile of back copies of the quarterly *CREG Journal*, I learned that much work had been done in this field, but that despite talk and theorizing, to my surprise no one in the group had actually built working cave radios.



The "Mini Troglophone" cave radio developed by the author and his colleagues in the Cave Radio and Electronics Group (CREG). Communication is by magnetic induction, so technically it's not a radio. However, it sure looks, talks, and sounds like a radio. (Photos by the author)

It must be stated that there had been a successful cave radio, "The Molephone," used by rescue groups for perhaps 15 years, but its inner workings were secret and sealed in potting compound. Another working example using the filter method was the "Ogophone," used by the Welsh rescue group. (*Ogof* is Welsh for cave.)

First Experience Underground

The cave entrance was a dust bin (trash can) lid hiding a 40 gallon oil drum through which one slides into the cave at a 45 degree angle. Soon came the horror: The cave height quickly lowered to 4 feet and the water was 3 feet deep. After that (thankfully), the cave opened up to a long, meandering walking passage. My initial radios did actually work, but I fear they left a lot to be desired in selectivity, noise figure, and cave proofing. Still, I was hooked.

Ten years ago as a club project I had built a successful HF SSB transceiver, and I still had a supply of printed boards on hand. An LF phasing transceiver could be put together quickly; only the crystal oscillator-divider and a power amplifier (PA) had to be added. Caves being harsh places, much attention was given to ruggedness and waterproofing. The finished radios were built of steel and carried in ammunition boxes.

One of the first changes I made in the initial design was a new RF stage in which the low-noise op-amp was replaced by a good, old-fashioned FET

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cascode with similar gain. This resulted in a 22 dB improvement in noise figure, and the change has been retained in later circuits.

Magnetic Induction

Radio waves don't penetrate solid rock very far unless you have a megawatt or two. Communication underground is by *magnetic induction* using multiturn loops (imagine a transformer in which the primary and secondary windings are separated). It is because of this difference—magnetic induction rather than electromagnetic radiation—that this technically is not radio. However, that's the only difference. Resonating the loops gives a hundred-fold improvement. The alternating magnetic field decays according to an inverse cube law: Each time you double the distance, you lose 18 dB, starting at 1 meter.

bly on site. It was found that six spreaders formed a roundish loop which showed almost 2 dB improvement over the square formation. Some workers had used ribbon cable; this can soon become shredded in the cave environment. A 1 meter diameter hula-hoop of similar gauge hook-up wire was also tried. When this was replaced by much heavier 6 amp cable, a 6 dB increased signal resulted. When this too was doubled—that is, two 13-turn windings connected in parallel—a further 6 dB resulted. This most likely could not go on forever; in any case, a great chunky loop would be hard to transport. Next it was found the 10,000 pF 400 V polyester capacitor was getting hot and drifting. This was replaced by a series-parallel network of four 10,000 pF 1600 V polycarbonate types and a further 4 dB lift resulted. These improvements are like increasing power 40 times, which

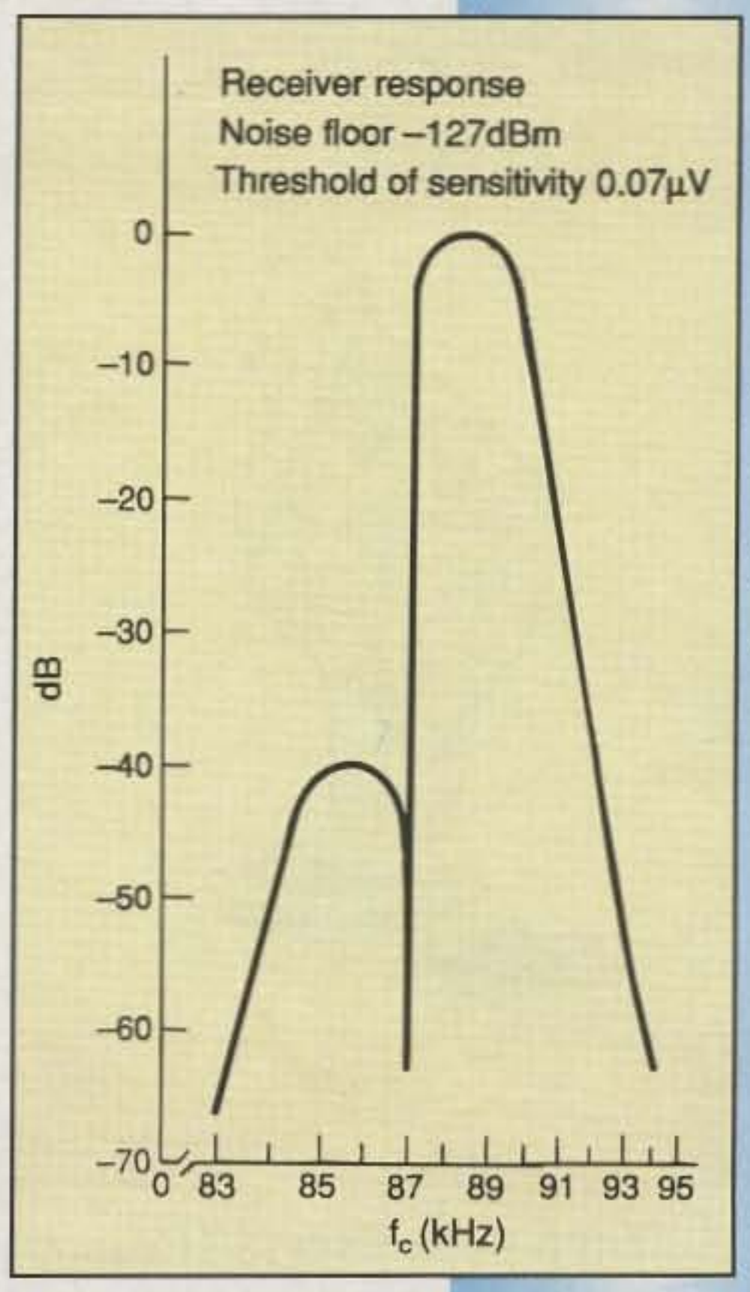
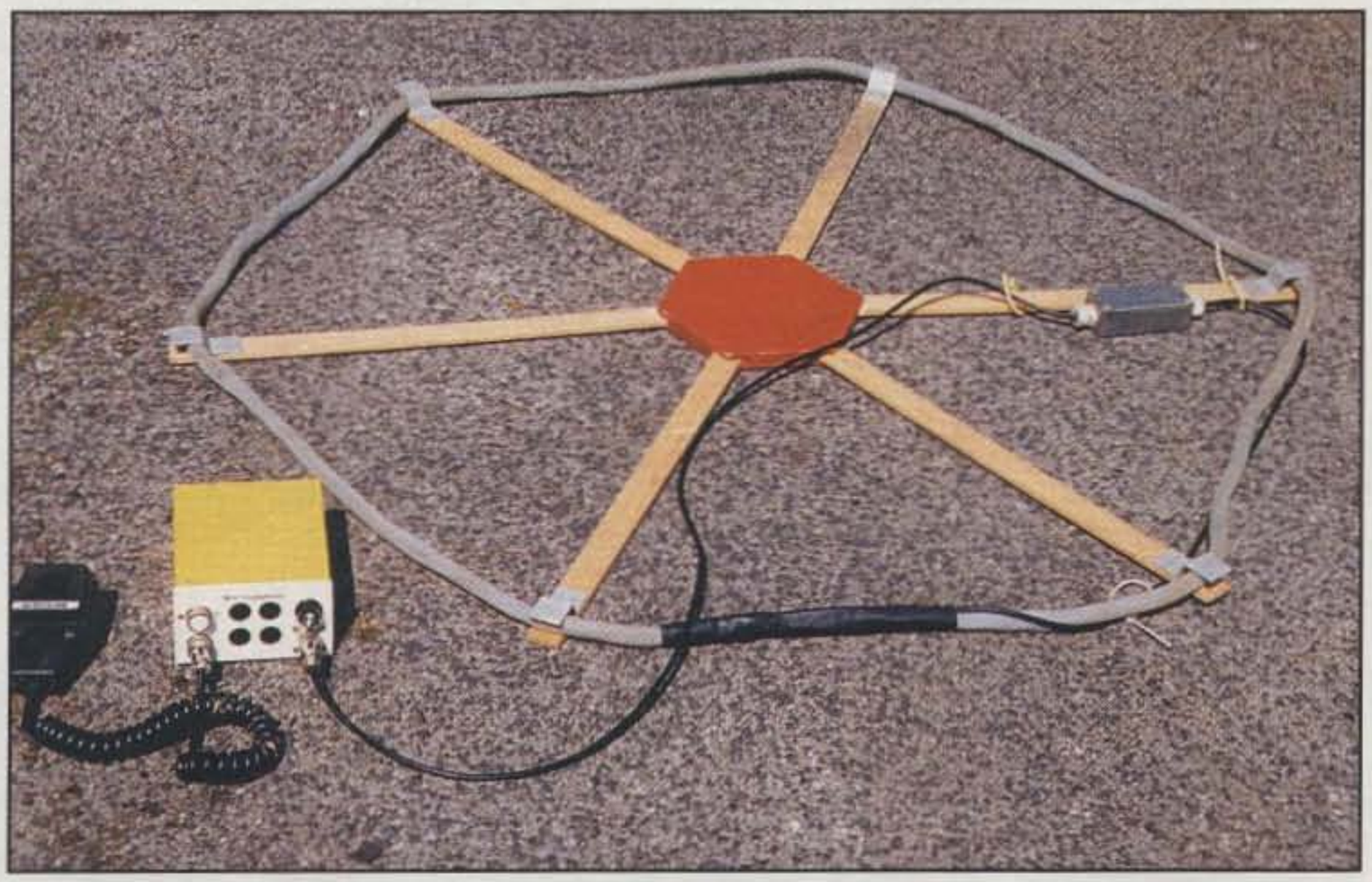


Fig. 1– Receiver response curve of the author's cave radio.



Cave radio and loop antenna ready for communication from underground. The radios operate on USB at 87 kHz.

With two radios at our disposal (we call them *radios* for convenience), our first experiments were aimed at improving the loops. First, we had to throw out the hallowed 50 ohms. On receive, the series resonated loops form a bottom capacitor coupled pair with the first RF stage tuned circuit. The transmitter uses a car radio AF output chip which has a very low output resistance. Our old textbooks might suggest a series tuned circuit would form a short circuit, but DC resistance, RF resistance, dielectric loss, and proximity effect add up to about three ohms, which suits the PA just fine.

Earlier systems had used a square loop for easy construction and assem-

seems impressive until it is pointed out that to double the distance, you must increase transmitter power 64 times.

Taking field strength readings at intervals above ground and plotting on an inverse cube graph enabled expected signal strengths to be estimated at greater depths. From this we guessed that at 120 meters (almost 400 feet) the signal would be down to 1 uV.

The resonating capacitors are housed in a diecast box halfway down the 2 meter (6 foot) long coax feeder. The amplifier's low output resistance suggests very high Qs are likely. At the L and C junction hundreds of volts can be found. With Qs of 60 to 100, one might

expect very poor audio. However, this is not the case. The loops were resonated at 88 kHz and the audio sounds excellent. The loop is not too troubled by the wet cave floor, but complete immersion causes havoc. Some workers who want to use our radio design for diving have made a loop from screened cable, which they say works well underwater.

One experiment was to see the effect of unfastening one of the spreaders to allow the loop to sag. An 18 dB loss resulted. However, retuning established the loss due to the sag was only 4 dB, with detuning being the main factor.

The Radios Today

Our new radios are very much smaller than the first ones and the 1496 mixers have given way to 4053 CMOS switches (my original motivation, as you'll recall). On the receive side, the well-published single op-amp balanced amplifier used with switching mixers is balanced only with a trim pot, and even then input resistances remain unequal. It has been argued that careful balancing is not necessary, but oscilloscope examination of the mixer output revealed so much mush that signal recognition was difficult. Third-order low-pass filters following the mixers improve things.

We found an even better solution, however, by using an inherently bal-

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anced circuit with two high-impedance inputs and a sample-and-hold technique. This circuit is familiar to instrument engineers but is not seen often in amateur designs, so here is a brief explanation:

By using two op-amps instead of one, you get perfectly equal inputs. However, each op-amp went ga-ga (highly technical term) whenever the switch was open (during the half cycle that the other op-amp was "on"). Therefore, we included a capacitor that charges up (the sample) while the switch is closed and holds its value when the switch is open, keeping the op-amp at that fixed signal voltage until it is refreshed on the next half cycle.

The result is a circuit that is well balanced without need of trim pots, and the circuit's outputs are now so clean that the low-pass filters have been discarded. The unwanted sideband rejection has risen from an adequate –32 dB to a healthy 40 dB. Unfortunately, the mixers loaded the RF stage, so a buffer of modest gain was added (see receiver response curve in fig. 1).

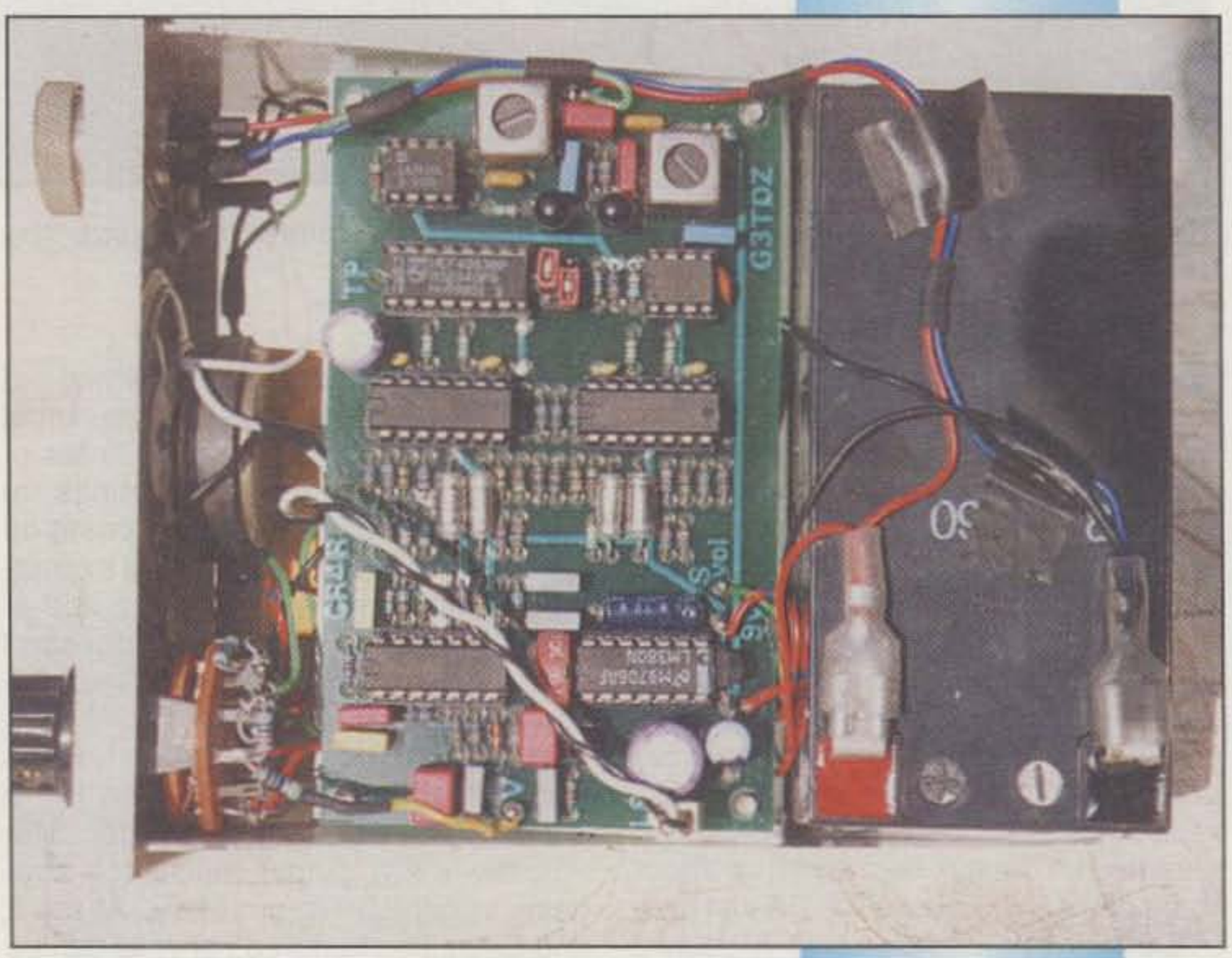
The audio phase-shift networks, always the bane of amateurs, are made from off-the-shelf values and driven from low resistance in the ratio 3.5:1, their outputs buffered and then combined. The signal passes a third-order Butterworth filter and a second-order Chebyshev filter. An audio AGC circuit was devised in U5d, Q3, and D1. From here, normal volume control and power stage follow. Oscillator injection comes from an oscillator divider with 5.568 MHz crystal situated on the transmitter board. Jumpers select the desired sideband.

The Transmitter

The transmitter follows fairly familiar lines with a single mic amp and a third-order low-pass filter at about 2.8 kHz with an inverting stage to give two p-p signals in the ratio 3.5:1 for the phase-shift networks. Switching modulators using 4053s are driven from the 4046 crystal divider with a 4013 to generate the two quadrature signals. Carrier balance is achieved by adjusting the center line voltage at the two op-amps.

The signal combiner is as simple as can be imagined with a single transistor. Here is the only tuned circuit in the whole transmitter. A car-radio audio amp, TDA2003, forms the PA. Up until this stage, DC coupling has been used throughout, either with a center line or reference voltage generated by one of the ICs.

Powered by an internal 12 V 1.2 Ah gel cell battery, the whole set is housed in a steel case and on a steel chassis as part of the necessary cave-proofing. Controls and connectors are kept to a minimum and all mountings are waterproofed. The loudspeaker is a Mylar waterproof type. The volume control uses a switch, as these days most ordi-



Interior view of Mini Troglophone showing receiver board and gel cell battery.

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nary volume controls have easily broken plastic shafts; this switch doubles as an on/off switch.

More about Aerials (Antennas)

An alternative to the loop is the use of earth current electrodes. Since at least World War I, it has been known that connecting an audio amplifier to a pair of suitably spaced earth electrodes enables speech to be picked up some distance away, say across a river from a similar pair of electrodes.[2] The amplifier must have been as powerful as could be made in those days and undoubtedly was very heavy. Unfortunately, reception could be ruined by nearby overhead power lines or a thunderstorm in the next county. Putting the audio onto a carrier, or better still, transmitting SSB, together with selective circuits, overcomes these problems.

From our antenna socket, a 10:1 step-up ferrite transformer feeds two electrodes typically about 50 meters apart. The received signal now is very much stronger down in the cave, using the loop vertically positioned. A field-strength meter has been constructed so that meaningful readings can be gotten. We first tried this at Box Mines in Wiltshire. These are ancient stone mines under Box Hill. Here a 35 dB improvement over twin loops was recorded; this must allow communication at much greater depths.

We next tried earth electrodes in the cave, recording a further 30 dB increase. As one cannot drive electrodes into rock, lengths of copper braid connected to 10 meter lengths of cable were placed into water or at worst muddy patches. When first tried at Bull Pot of the Witches, the signal overloaded the receivers; reducing spacing overcame this.

A trial was organized at Peak Cavern in Derbyshire. We took the radios and ground wires deep into the cave where communication previously had been impossible. At a point called Main Stream Inlet, where two streams converge, we placed an electrode up each of the passages, just dropping the wires into the running water. Our first call brought back a massive 5 and 9 report. We were very pleased. At a second location, Far Sump, we received a similar excellent report.

With such satisfying results, a demonstration was organized in April 1999, with visitors from France, Belgium, and all parts of Britain gathering at Peak Cavern. We had four stations working, two above ground and two below; the

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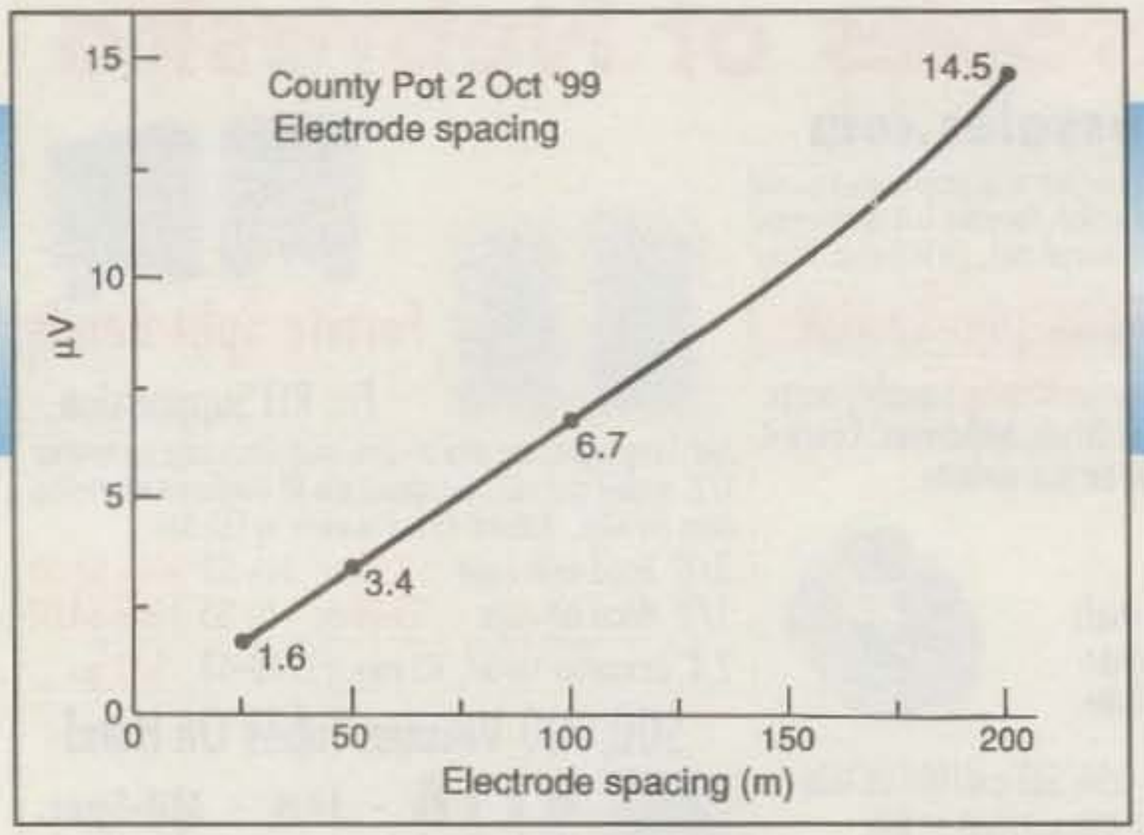

Fig. 2– Signals at the County Pot cave were appreciably lower than at the West Kingsdale cave (see fig. 3) due to differences in geology. (See text for details.)

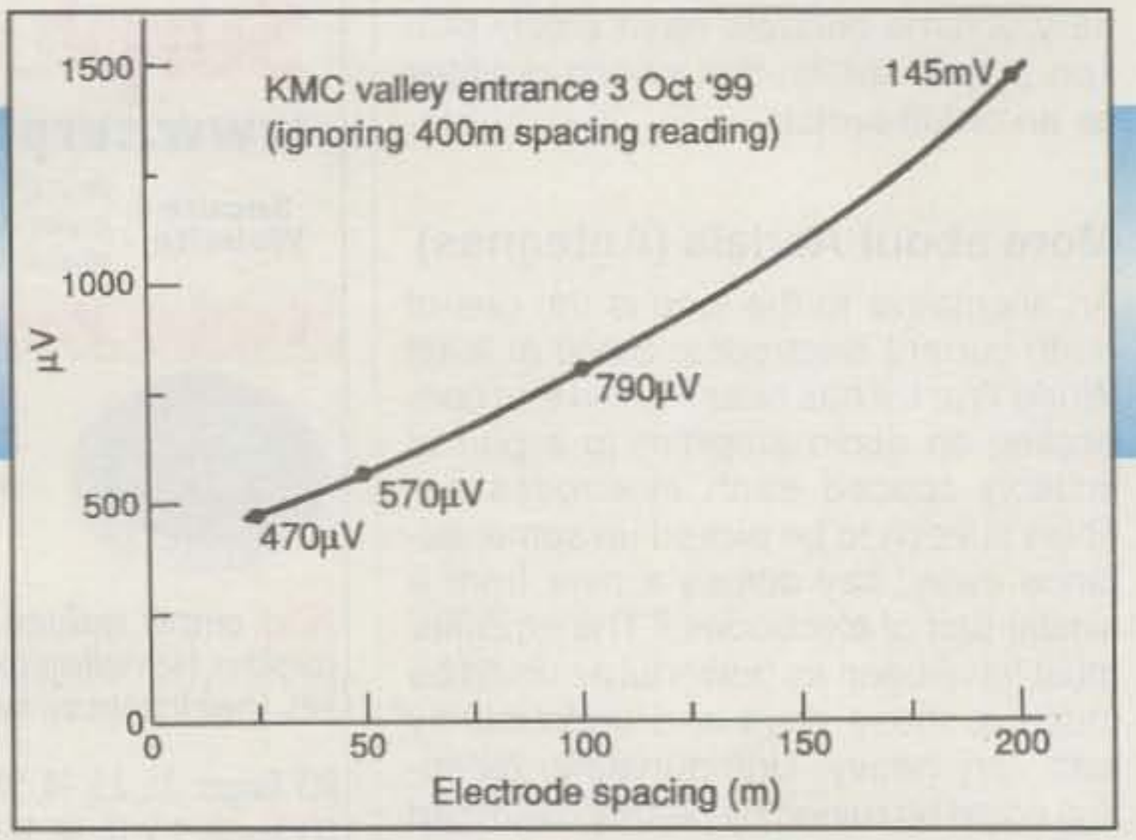

Fig. 3– At the West Kingsdale Master Cave, where the limestone is very close to the surface, signals were much stronger than at County Pot, where there are "insulating" layers of sandstone and peat.

greatest distance achieved was 500 meters. Since then the French have achieved greater depths using their Nicola system.

Does the Geology Matter?

In France it was found their signal could be detected almost 1 km away along a limestone bed. Here in the UK, we have carried out tests to determine optimum electrode spacing. Widely differing signal strengths have been recorded, depending on the geology. At County Pot, where there is a thick layer of sandstone over the limestone and a heavy overburden of peat above this, signals were weak though solid copy was maintained (see fig. 2). Much stronger signals resulted in a similar test the next day at West Kingsdale, where the limestone is much more obvious (see fig. 3). Where the electrodes seem "insulated" from the limestone, cave workers in the US have found it better to place the electrodes at the cave mouth rather than on the hill above.

The two graphs indicate that the wider the spacing, the better the signal—up to a point. We found with spacings at 400 meters (not included on graph), the signal dropped noticeably; somewhere just over 200 meters seems maximum, but we suspect this depends on depth and local geology.

Bright Ideas

Our gang is often driven by "Have you tried..." or sometimes by the more negative "Why haven't you tried..." It was suggested that the electrodes didn't actually do anything and that the connecting wires acted as a loaded dipole. Thus, off we went to Roger Kirk Cave, where we laid out the normal 50 meter electrodes. A field-strength reading was noted, and the connecting wires were raised 1 meter above ground on garden canes. Exactly the same reading resulted. Lengths of coax were substituted and their shields joined; the same figure resulted. Finally, the ends were disconnected from the pegs and the signal was lost. We rest our case.

Someone else, in their wisdom, insisted a loop would actually radiate a radio signal. A short, active dipole was constructed using a pair of FETs and an NE592, and the loop was fired up. I admit to a slight disappointment when a strong signal was copied, but as the distance was increased, it was obvious that the level faded according to an inverse cube law. From a radiation resistance of maybe 0.04 ohms, what should one expect? Experiment closed.

Finally, I was asked why I use the old LM380 rather than one of the new class

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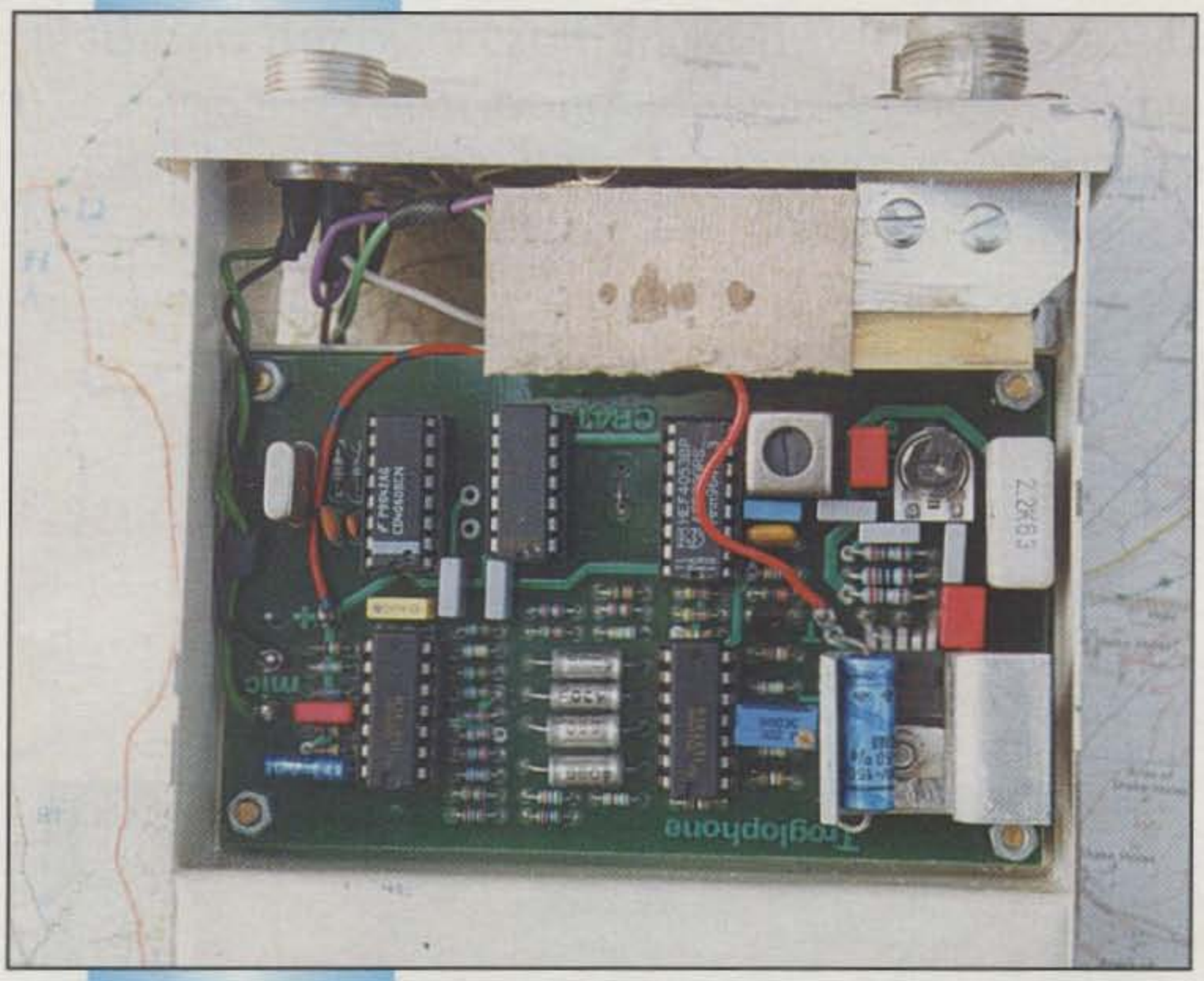

Interior view of the cave radio showing the transmitter board. There is only one tuned circuit in the entire radio.

D switching amplifiers. When you are down in the cave and someone nearby switches on a photoflash, all hell breaks loose. Now it might be possible to synchronize the switcher to the carrier oscillator, but something to do with nuts and sledgehammers comes to mind. The good old clunker is well proven and requires only two peripheral components.

Conclusions

CREG has members in the US and Canada, as well as in Europe. In fact, two of our most regular contributors are from the North America side of the pond. At present, 50 cave radios are being built for the rescue groups.[3] These have a third printed circuit board which carries "start of transmission" and "end of transmission" bleeps; a beacon which sends either 1 second bleeps or Morse code, and a confidence tone which is a bleep every half minute.

Our next assignment is to visit the tin mines in Cornwall to prove to the local Cave Rescue Organization (CRO) that the radio will operate in ore-bearing surroundings. We've recently expanded our scope of operations to manmade "caves" as well, working with rescue personnel beneath the streets of London and in the 3 mile long Marsden railway tunnel.

There are a number of limestone areas in Britain, all located in beautiful country away from big cities and metropolitan areas, making our gatherings a bit of a holiday. My QTH in northern England puts me just over 30 miles from the caving areas. It's a hard life.

Notes

1. In 1996 the UK authorized experimental operation by amateurs on 71.6–76.4 kHz, subject to individual "Notices of Variation," the UK equivalent of STAs, or Special Temporary Authorizations, issued in the US by the FCC. In late 1997 and early 1998, the UK and many other European administrations approved a permanent amateur LF allocation at 135.7–137.8 kHz.

Operation on 71 kHz in the UK was supposed to end in June 2000, because of the new permanent allocation at 136 kHz. However, the Radiocommunications Authority extended the NOVs to June 2001, and there are reports that some are being renewed for three additional years, although no new authorizations are being issued.

In the US, the ARRL has petitioned the FCC for amateur allocations at 136 kHz and 160–190 kHz, and several hams are operating on LF under STAs. The rulemaking proceeding is moving slowly. Canada is authorizing LF operation on an individual basis (similar to the US), and an attempt to complete a two-way transatlantic QSO between Canada and Europe on 136 kHz was scheduled for November.

Tnx to the Longwave Club of America <http://www.lwca.org/sitepage/lfham/lfham.htm> for this information.

2. Apparently, this method of communication was known well before World War I. See the article "An Underground 'Radio' Transmitter, Circa 1901" in this issue of *CQ* for details.

3. For those interested in building this cave radio, an article on its design and construction, including schematics and PC board templates, also by G3TDZ, appeared in the September 1999 issue of the *Journal of the Cave Radio & Electronics Group*, published by the British Cave Research Association. For more information, contact Rob Gill, G8DSU, at 61 Cross Deep Gardens, Twickenham, Middlesex, TW1 4GZ, United Kingdom, or e-mail him at <creg@bcra.org.uk>. Further details on all CREG publications can be found at <http://www.bcra.org.uk/creg/>. ■

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In the previous article, G3TDZ described how he has designed and built state-of-the-art radios for underground communication. The concept is hardly new, however. Turn back your calendar a full century and "dig into" WA2JHD's tale of underground radio in upstate New York.

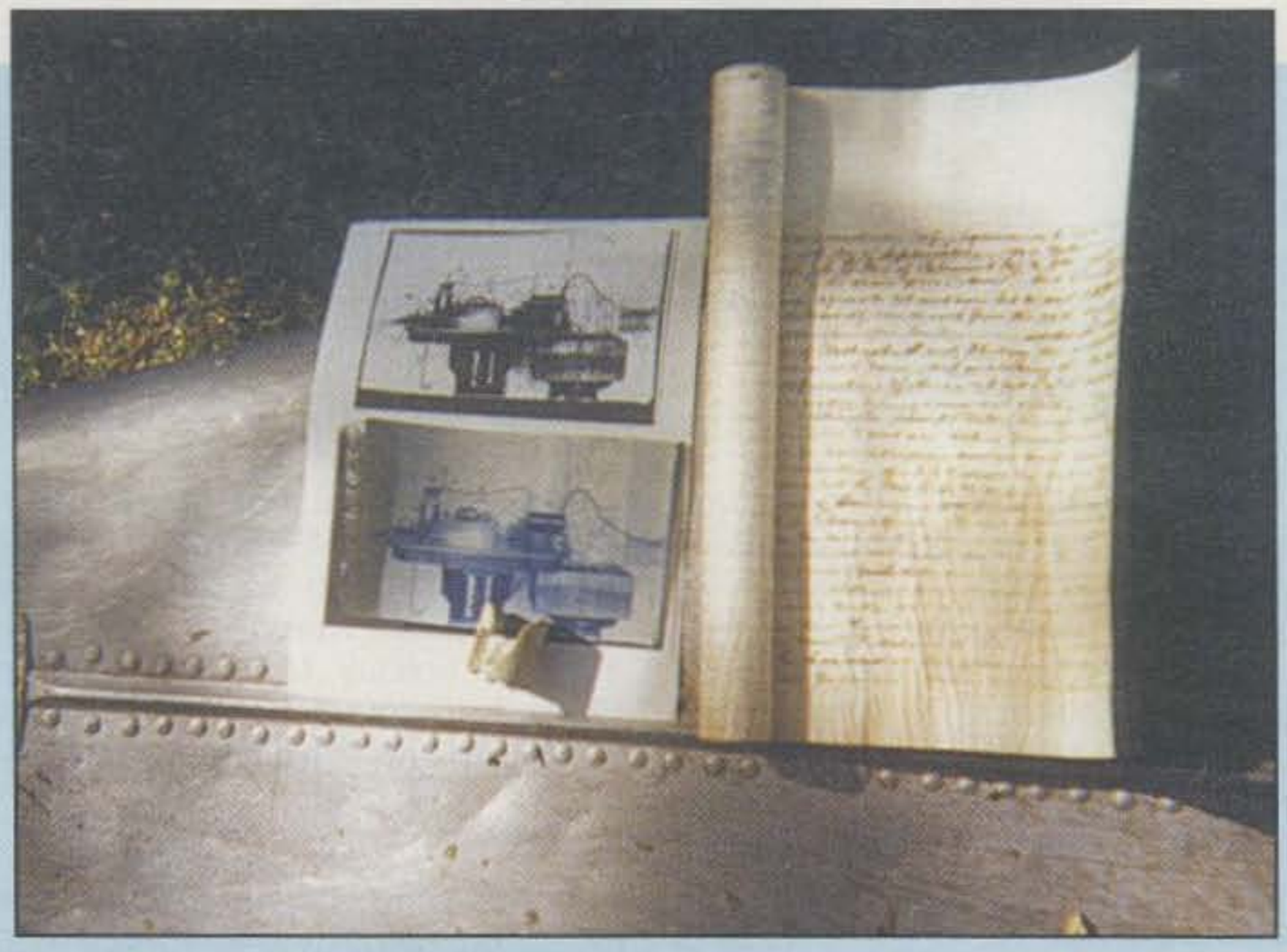
An Underground "Radio" Transmitter, Circa 1901

BY BILLI GREENE,* WA2JHD

One of the nice things about historical events is that they can, and do, happen at any time, and in any place, sometimes in your own backyard. Things that seemed insignificant in their own time can turn out to be milestones with the benefit of hindsight. This is an account of one of those little-known episodes that contributes to what we know of as radio. This, as nearly as I can reconstruct, is the story of the Ancira-Gorton-Barney ground-wave transmitter, possibly the first radio transmitter in the United States[1] and most certainly a previously unknown chapter in radio history.

To set the scene for our story, let me provide some related background. As a retired County Historian, I regularly receive items of local historical interest. One of these items which came into my possession is a notebook from the estate of Ruth Gorton Garrison. At the time I received it, I gave it only a passing glance, because most of the notes seemed to relate to contracts concerning a local storm sewer built by Mrs. Garrison's father. I am sure that anyone not into ham radio would have let it go at that. However, when I had a chance to study the material in depth, I discovered that the last seven pages seemed to relate to a picture of some ancient electronic apparatus which was also in the collection.

To be precise, the material consisted of faded carbon copies of notes, and a letter to a Mr. C. Viadero concerning some patent papers that Mr. Charles Gorton of Belmont, New York was having prepared by a Mr. Baner. (Belmont is a village of about 1000 people approximately 300 miles west of New York City *(and nowhere near Belmont Racetrack, which is in Elmont, NY—ed.)*. The more I read, the more exciting the material became. From the description of the "apparatus," it became apparent that I was reading about what could have been the first radio station in the country. Even more amazing, it seems that the antennas were *underground!* [2]



Drawings of Ancira-Gorton-Barney wireless apparatus (left), insulator found in attic of Dr. Barney's sanitarium (bottom of lower photo), and original carbon-copy notes of Charles Gorton. (All photos/illustrations courtesy of the author)

My first challenge was to pin down as closely as possible the year in which all this took place. After reading the documents for the umpteenth time, and trying to fill in the blanks, it dawned on me to get a perpetual calendar, because in the letter Mr. Gorton states that he planned to "... go west on Tuesday Aug. 7 and expect to reach San Francisco Sunday next week ..." (presumably on company business, as he was an engineer for Standard Oil). The calendar shows that August 7 fell on Tuesday in 1894 and in 1900. Marconi came to New Jersey to cover the America's Cup race in 1899. DeForest set up his laboratory in Chicago in October of 1900. In the front of the notebook was an endorsement for the book saying it had won a prize at the World's Fair. That fair was in 1893. A trip to the Antique Wireless Association Museum in Bloomfield (for-

Allegany County, NY Historian emeritus, 20 Willets Ave., Belmont, NY 14813

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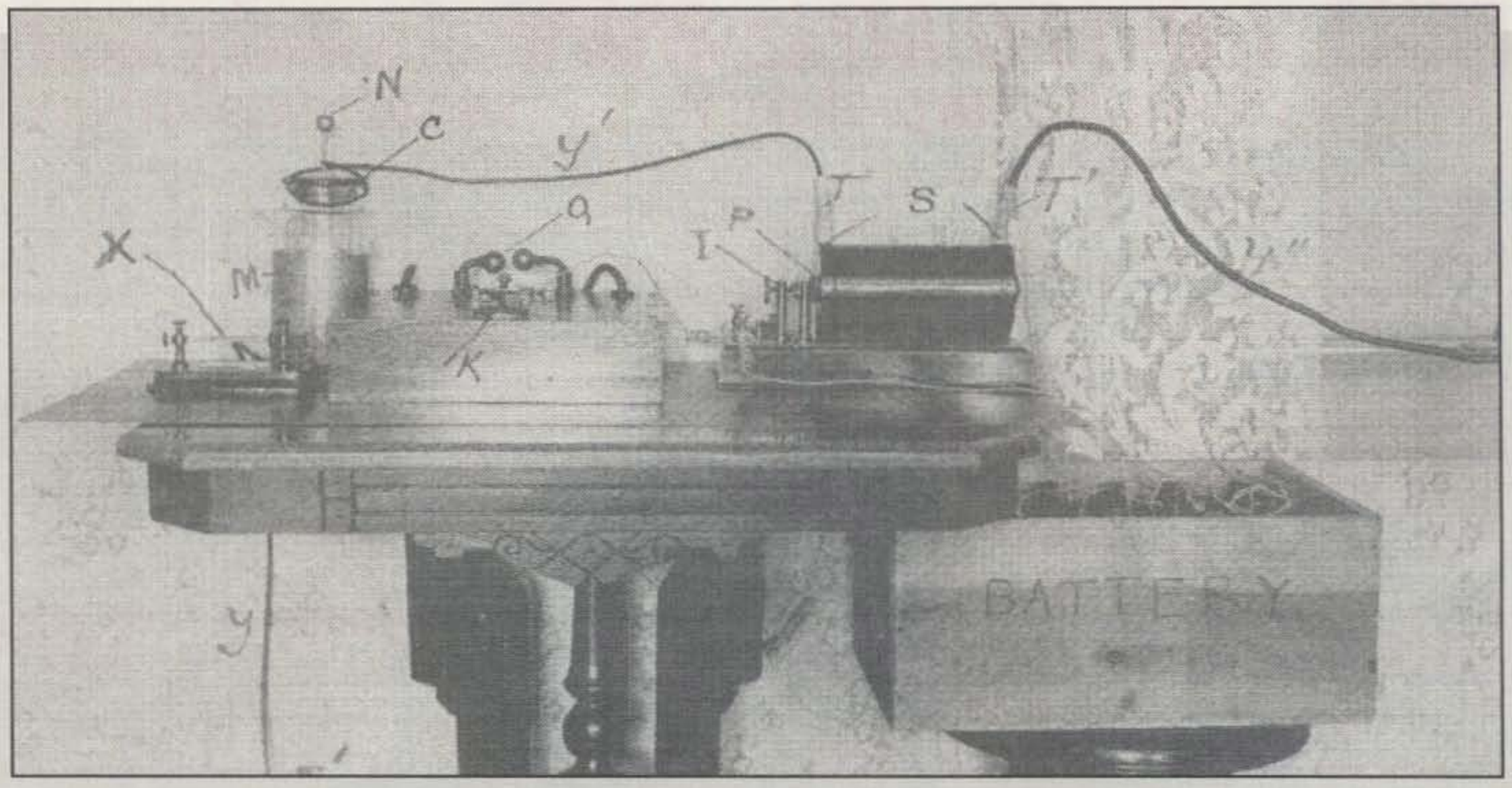


Annotated photo of radio apparatus. The following key appears on the back of the original photo: "C – Condenser; K – Key in circuit with Battery and Primary Coil P; I – Interrupter also in circuit with P & C; O – Oscillator not used in later experiments; X – Coherer not used in later experiments; S – Secondary 'circuit' of Induction Coil; T T' – Terminals; E E' – Earth wires connected to ground plates; M N – the External and Internal "armatures," respectively, of Condenser C; Y Y' Y" – Conductors, heavily insulated."

merly Holcomb), New York yielded the information that the coherer—an essential component of early radios, but one noted here as being tried and then discarded—became generally available in about 1893.

I was zeroing in on the date, but what was actually taking place and who all was involved? The buildings mentioned are all still here. This county claims to be the birthplace of the Republican Party, but loses out to Michigan and Wisconsin for lack of proper documentation. If I were to claim something before Marconi's arrival, I would need solid proof. Unfortunately, there is not yet enough evidence to make such a claim, only enough for conjecture.[3]

Setting the Scene

Mr. Charles Gorton, and his associate, Herbert Barney, M.D., along with various members of their families, had assembled the pictured equipment at his home on the edge of Belmont and at Dr. Barney's office in the center of the village. Apparently, a third set was located at the home of Leander Gorton (science teacher, surveyor, and father of Charles), a quarter mile outside the village. Also involved were Ella Clark Gorton (Charles's wife), their daughter Ruth (in whose papers *these* papers

Gorton's Letter to "Mr. Viaderio"

Editor's note: The following are transcriptions by the author from the carbon-paper originals. Not everything was readable, and in some cases the author and/or editor guessed at the logical word(s) to fill in a blank (material in [brackets]) and in others, we just left them blank. We also tried to keep as much of the original spelling as possible, to give you a flavor for the times. This applies to the specifications and notes as well.

Belmont NY Aug 6
Mr. C. Viaderio
111 South William St.
New York

My Dear Sir:

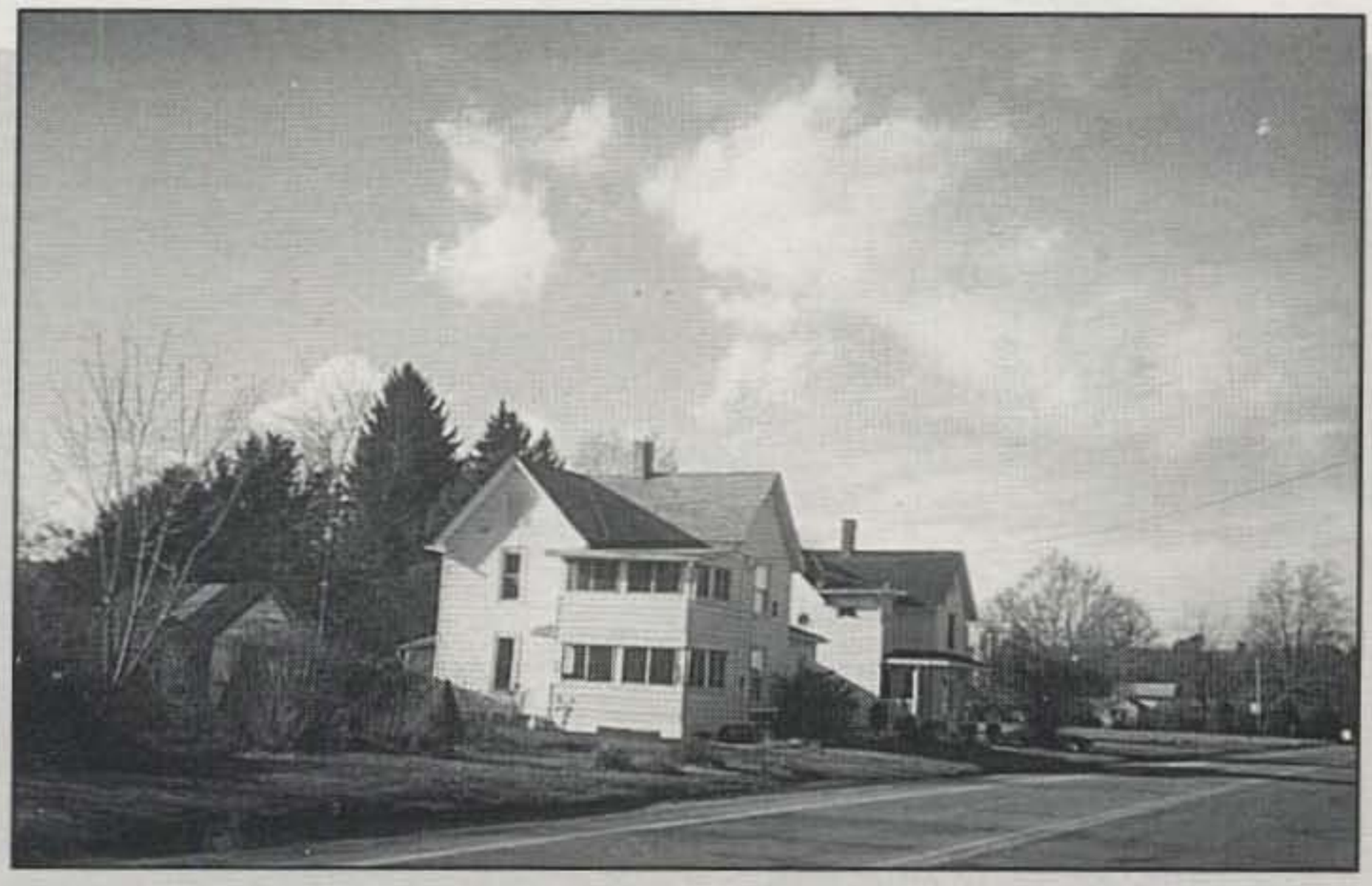
I have received both your letters and have been putting in full time to be able to answer them [fully]. I am unable to get the drawings [made] here, for the Patent office: but am sketches and a carefully written description of our apparatus which I will mail to you when completed, from which I trust Mr. Baner will be able to prepare the necessary specifications. Although I think _____ to go slow enough to be _____ of obtaining a _____ _____ go west on Tuesday Aug 7 and expect to reach San Francisco Sunday next week, where I will get mail in _____ 421 Market St - I shall endeavor to ____ the papers on my way out _____ drop them _____.

I am sorry not to be able to lay this matter plainly before you and our friends at once and personally, but it seems impossible to do so. My trip is likely to consume about two months and meantime, I hope to have verified all our work mathematically, although my experiments, about forty in number, since Dr. Ancira left have given me very satisfactory proof of the truth of what you say you stated to the Herald — It is certin that I have received signals by our system for distance of over 20 miles through the earth. Since the "Doctor" left I will write him _____ which are somewhat technical.

My idea would be not to croud the Herald any but let them come to us now that they have been "seen."

With best reguards from all here.

Yours Sincerely
Charles Gorton



Charles Gorton's home outside Belmont, New York, was still standing and still occupied in December 1999, nearly a century after the experiments described here were conducted.

were found), and at least two unrelated witnesses. They were Dr. Barney's neighbor, a local businessman named H. C. Vanderhoff, and a Mr. Griswold. As it turned out, daughter Ruth was sending some of the telegraphy at the age of 12.

Basically, what they had done was hook the apparatus first to a steel well casing some 150 feet deep, and later to some specially constructed wire-mesh cones buried in the ground. I get the impression that these were similar to UHF dishes, and that they were hooked up in a dipole manner. The experimenters and the witnesses distinctly heard messages in Morse code coming through the earphone. They also heard what they assumed to be noise generated by the motors of trolley cars at Olean or Hornell about 30 miles away. The soil conditions at Belmont are river-

Specifications for the Ancira-Gorton Transmitter

Belmont NY July 31,

Specifications of the Ancira Gorton Wireless Telegraphic Apparatus

What we have discovered and believe to be new in Wireless telegraphy is the following.

1st. – In a wireless telegraph transmitting apparatus an electrical series consisting of the secondary "circuit" of an induction coil "S" (shown in the accompanying print), a Condenser "C", Earthplates E E' buried in the earth, the one deeper than the other, and conductors Y, uniting E' & M); Y', uniting N&T (of the print); and Y", uniting T'&E.

In combination with the primary circuit consisting of Key "K", Interrupter "I", Primary coil "P", all in series with a battery or other source of Electro-Dynamic energy, whereby the closing of the Key K sends electrical impulses by induction through S to E E' via the conductor Y Y' Y", the condenser C serving to reverse the polarity of the waves or impulses induced in Y', causing waves of like polarity to reach the earth at E & E' respectively, thereby administering an electrical "kick" to the earth.

2d. – In a Wireless Telegraph receiver a modification of an ordinary telephone receiver wherin the permanent magnetic field is very strong and the coils are _____ in circuits with two earth _____ in the earth, the one deeper than the other. The plates being connected in series with the coils of the "receiver" by means of insulated electrical conductors.

(Signed) J. Mortenege Ancira
Charles Gorton

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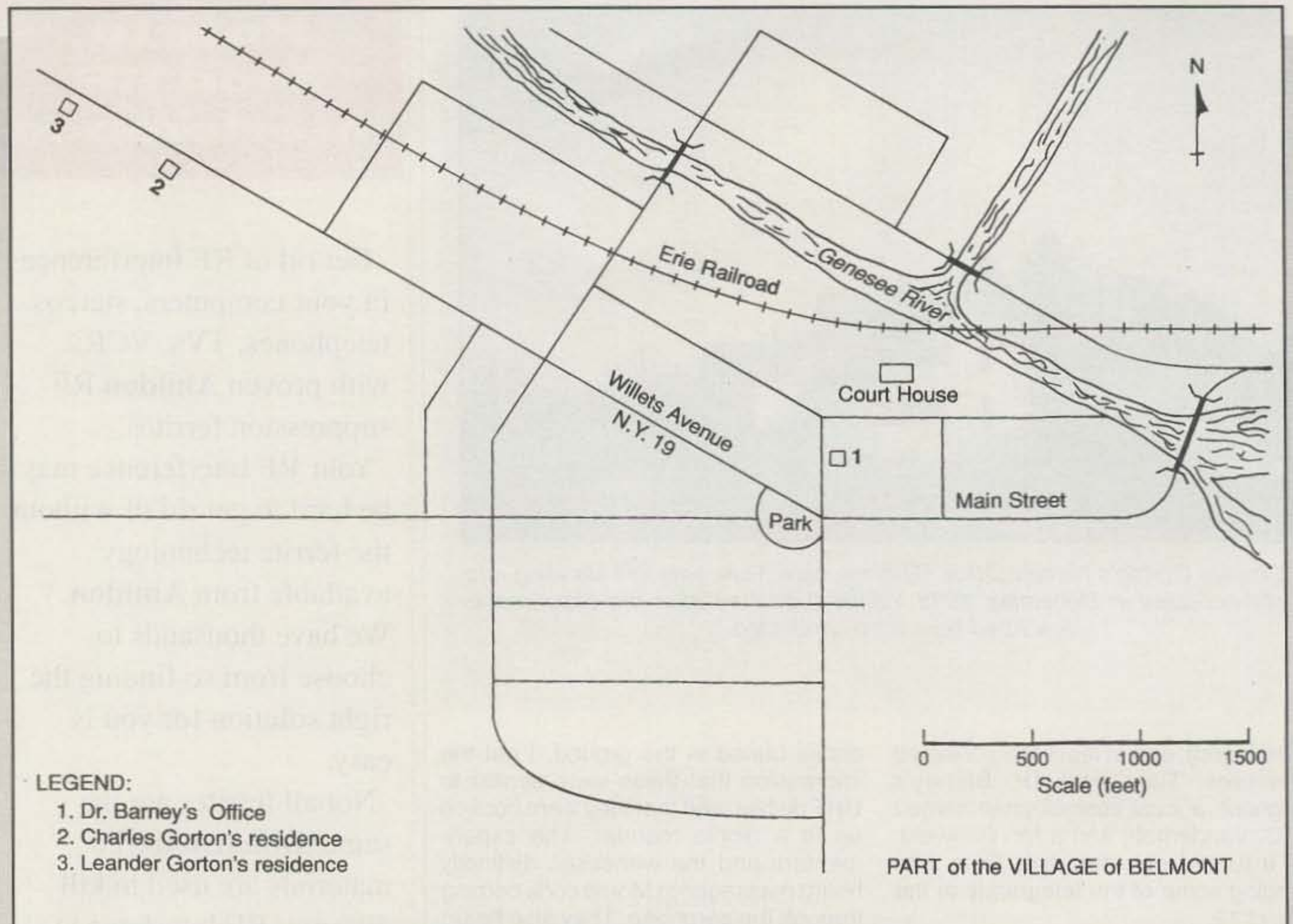


Fig. 1– Detail map of Belmont, New York showing the relative locations of Dr. Barney's office (1) in the center of the village, Charles Gorton's residence (2) on the outskirts of town, and Leander Gorton's residence (3) about one-quarter mile out of town.

This white house, also photographed in 1999, was Dr. Barney's office at the time of the experiments. The small dish antenna mounted to the chimney is not related!

bottom deposits of sand and gravel overlain by six feet of loam. The water table is in the gravel. The notes make passing reference to a natural-gas line. We are in oil and gas country, and the lines are everywhere. You will note, however, that there is enough wire exposed so that some of the transmission could have gone through the air.

I had some help in conducting the research from my brother-in-law, Bill Hood, W2FEZ, who is a technical writer and author on various radio subjects. He was able to get us access to laboratories where we were able to examine the papers under ultraviolet and infrared light. Bill believes that the Dr. Ancira mentioned in the notes was a medical doctor located in the New York City area. He may have come from Vera Cruz, Mexico. How he came in contact with the other principals we have not been able to determine. However, we did uncover an old newspaper article that fills in many of the blanks. This gem

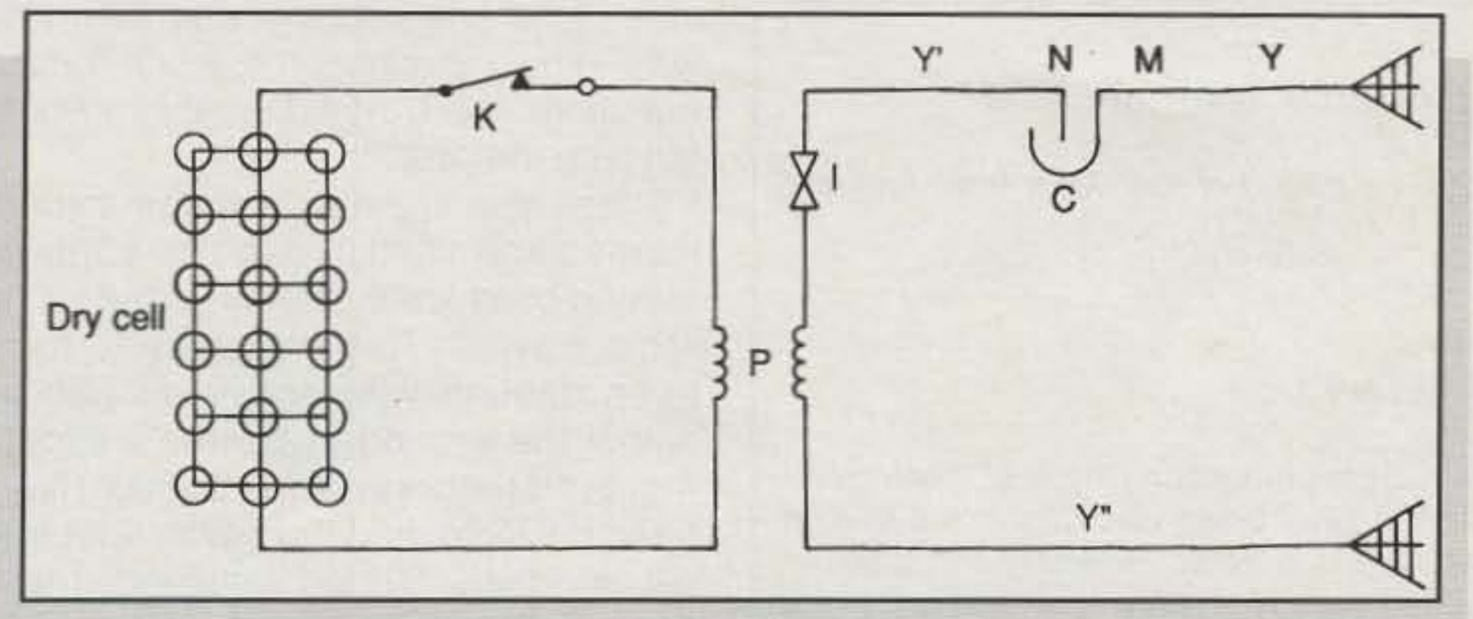


Fig. 2– Schematic of the Ancira-Gorton-Barney transmitter, reconstructed by the author from the descriptions in Gorton's notes.

appeared in the April 18, 1902 edition of the *Belmont Dispatch*:

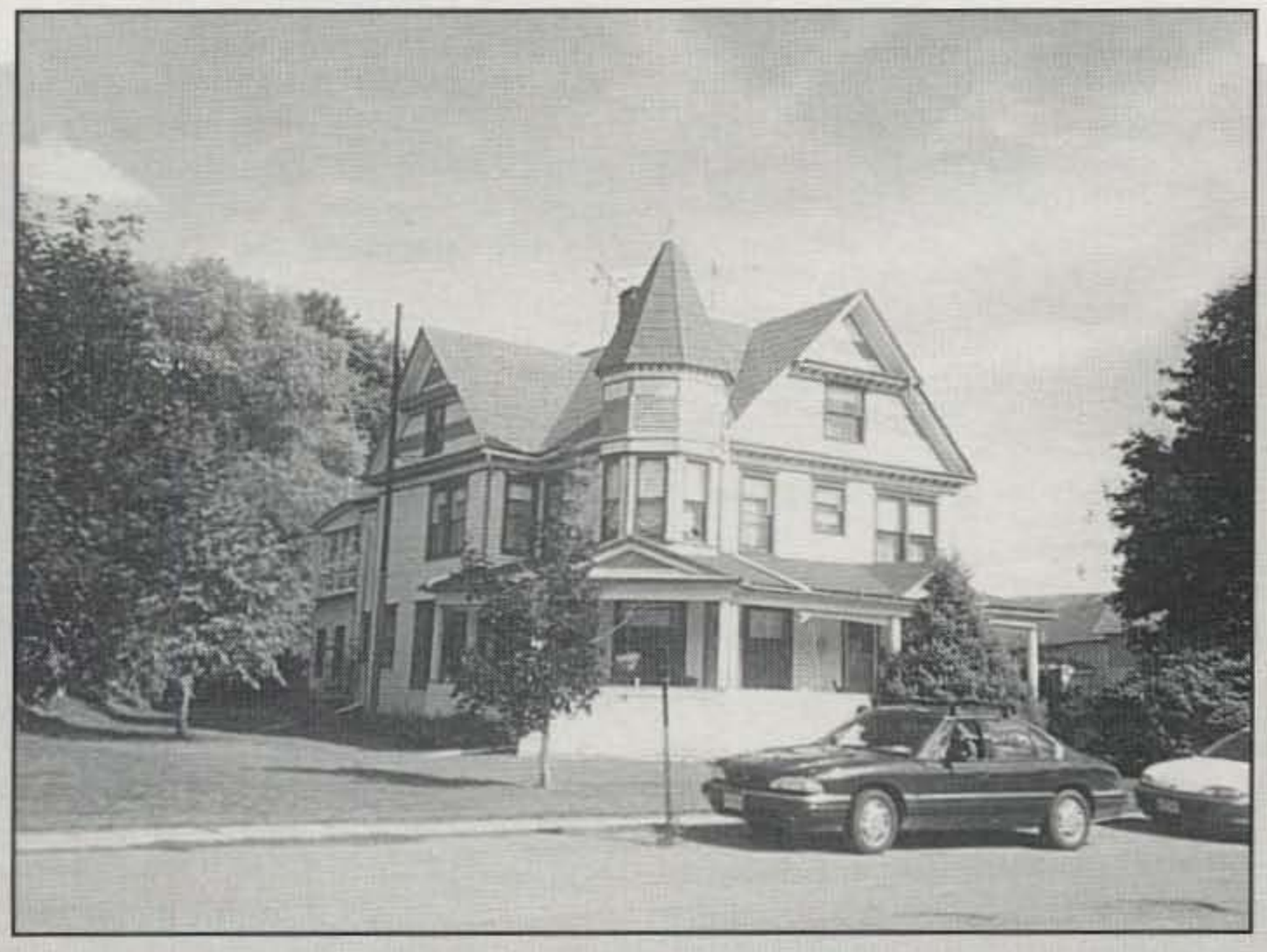
A Great Invention
New Method of Wireless Telegraph Perfected in Belmont

The past few weeks of experiments have demonstrated to Dr. Ancira, the Mexican scientist and physician, and Charles Gorton, our well-known civil engineer, that they have successfully discovered a new method of wireless telegraphy and telephony. It differs materially from that of Marconi, and will work as well in a storm as on a fair day, and has perfected transmission through the water and earth as well as the air. Dr. Ancira and Mr. Gorton do not have to use oscillators or coherers, and their instrument is such that with it Morse code can be transmitted from a concealed key in the operator's pocket if he desires to send his communications that way. Long messages have been sent through the Genesee River here, and the inventors' investigations have created much interest through the section.

Dr. Ancira is greatly pleased with the flattering results of efforts of Mr. Gorton and himself, and Monday he and Madam Ancira left for New York, and thence to Vera Cruise, and the City of Mexico, for a brief vacation to return to Belmont to complete the experiment about the middle of June.

Into the Present Day...

More recently, Lou Vossler, the latest owner of Dr. Barney's home (next door to his office), gave me a guided tour of



This was Dr. Barney's sanitarium at the time of the experiments. Insulators with single-strand wire attached were found in the rafters of the third-floor attic.

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Notes from Charles Gorton's Journal

Ed. note: These notes apparently were made over a period of four days, from August 5 to August 8, 1901.

Home of Chas Gorton

Experiments in wireless telegraphy Aug 5 Belmont NY

No 1 – Transmitter consisting of Irsun & Co's 1" Spark Induction Coil, T & T' being connected to the outer and inner armatures of a Lyden jar, T being also connected to a driven well G 15 feet deep of 1-1/4" galv iron pipe – 2 feet in water – Primary circuit actuated by 18 cells Meeco battery, three in parallel 6 in series – Receiver, ordinary Bell telp receiver connected to two tin cones having about Sq surface 4" unfrt [under?] moist earth ten feet apart and 120 feet south of ground wire G – Signals sent but no sounds received.

Exp No 2 – Same conditions with one of the cones moved five feet toward "G"-Signals sent and received but imp ly

Exp No 3 – Same conditions – cone moved to a point ten feet nearer G and in a direct line with the other cone. Signals sent and distinctly heard in receiver.

Exp No 4 – Same conditions – Cone moved to a point 20 feet from first cone & 100 ft from G, on [shary lot line] between them – Signals much more distinctly heard.

In the above experiments, cones were in each case laid upon their axes – horizontaly with ends facing each other the connection being soldered to apex in each case.

Exp No 5 – At dr H. A. Barney's office about _____ east
cables of receiver were connected _____ will [well?] about 60 feet deep & the other to the gas pipe in dr. Barney's office about 40 feet apart and in a line about N. E & S. W. Signals sent by Ruth Gorton at home of Chas Gorton _____and clearly heard in receiver – (telephone conversation was also heard at this point – a telephone being grounded on the gas line nearby may account for this.

Exp No 6 – At the L. Gorton Homestead 2850 feet N. W. from G connections were made by th _____ ordinary "annunciator wire" to turn _____ well pipes similar to G one however being driven about a foot only into the bottom of _____ well H. These wells are about 130 feet on NW side (?). Before signals were sent the writer noticed sounds like those heard when an electric motor starts, it being produced at the contact point of upon the armature – this was heard several times and must have been caused by the trolly motors either at Hornellsville or Olean – each about 20 miles away, East & West respectively in _____ being no "grounded" motor _____ where writer knows of.

Signals were then sent by Mrs. C. Gorton through G and _____ were faint however and _____ ground M was disconnected and contact with service pipe of the Producers Natural Gas Co.

When the signals were more distinct and several messages in "Morse" alphabet were received the "trolly" sounds were also more distinct although they didn't interfere with the receiving of the signals by the writer – The "Morse" signals consisted of long and short tones corresponding to the "dashes & dots" ____

L. Gorton was present at this experiment and listened to the signals which were sent by Mrs Gorton and Maud Gorton.

Dr. H. A. Barney, Mac. Griswold and H. C. Vanderhorf were present and heard the signals Experiment No. 5 The writer alone exps no.1,2,3,4.

The Producers Gas line extend to Olean [on a] circuitous route 40 or 50 miles long

Charles Gorton
Belmont Aug 8 1901

the house. The doctor apparently ran a sanitarium on the second floor, possibly catering to maternity cases. About halfway up the rafters in the third floor attic was a row of insulators with a few remnants of single-strand electrical wire. From the arrangement, I took this to have been some sort of dipole. Mr. Vossler gave me some of the insulators, one of which I have and the other I sent to the A.W.A. Museum.

I understand that the Army used underground transmissions in Europe as late as WW I, and I have seen a few other scatted references to the subject. With the untimely deaths of Charles Gorton (in 1904 from a heart attack) and Dr. Barney (in 1907 from a bad reaction to a diphtheria vaccine with which he was experimenting), there will remain questions as to how Dr. Ancira made out with the project.

Were the signals in these experiments transmitted through the earth via ground conduction or through the air via radio waves? There appears to have been enough wire above as well as below the ground in Gorton's experiments that either one or both might have been possible, and the newspaper article suggests Gorton believed it was both. Were these transmissions radio "firsts" for the United States, or one group among several conducted in the same time frame? Chances are we'll never know the answers.

Regardless, this is a fascinating story of early experimentation with wireless communication and the fact that, in the true spirit of amateur radio, "just plain folks" felt competent in attempting to see what they could do. They helped blaze the trail that radio amateurs continue to follow to this day.

Notes

1. The date of the "first" radio transmissions in America—or anywhere else, for that matter—as well as the identity of the person(s) responsible, likely will remain a subject of debate forever. The earliest claim to wireless transmission belongs to Dr. Mahlon Loomis, a Baltimore dentist, who in 1868 sent signals 18 miles through the air between two wires held aloft by kites. No message was transmitted, though. The extent of his experiments was to show that running a current through the wire attached to one kite caused a current to flow on the wire attached to the other kite.

—W2VU

2. In the same time period as Gorton's experiments, there were other claims to successful transmission of messages via ground conduction, not really "radio" to historians, since there was no "radiation" through the air.— *W2VU*

3. There continue to be some inconsistencies in the dates. For example, while August 7 was on Tuesday in that time frame only in 1893 and 1900, Charles Gorton's notes on his wireless experiments appear to be dated August 1901, including one marked "Belmont" and dated August 8, 1901, when Gorton should have been on a train to California. Whether the experiments were conducted in 1900 and written up in 1901, or if errors were made in date notations, remains unclear. — *W2VU*

The physical layout of your station, and your ease of interacting with your equipment, are important but often-overlooked aspects of how much you enjoy your hobby.

Human Factors in the Ham Shack

BY WILL DOGGETTE,* K3SRF

What do a space shuttle pilot making a night landing, a Navy SONAR operator listening for enemy ships, and a ham working DX have in common? All are using visual and auditory inputs to accomplish their tasks. For each, the human-machine interface makes a big difference in performance—the vigilance, efficiency, and safety while underway, and the fatigue when each is finished.

Space and military personnel work at consoles designed with the help of human-factors engineers with long checklists of human-machine interface items and huge databases about people's sizes and shapes. They consider everything from the control and display layout to the lighting and access for maintenance. For hams, the interface is not quite so critical. Except in an emergency, we can always get up and stretch and go to the kitchen for a snack. Still, using human-factors ideas can make your station more comfortable, efficient, and safe.

Here are some tips for evaluating and designing operating positions and workbenches, based on my experience with chemical-plant control panels, manufacturing workstations, computer desks, and the like. Combine these guidelines with your own experience and preferences, and you can make those long nights under the headphones easier on the body. No doubt much of human factors is common sense, matching the equipment to the users. But if you look at cramped airline seats, tiny HT keypads, and many other products, you'll see that common sense isn't so common. As the designer of your station, you're in a position to make it fit the operator and the mission.

Horizontal reach at station desk. Your most efficient work area is the heart-shaped space within reach using your forearms. For an average adult, the distance between the shoulder pivot points is about 13 inches. The radius of the forearm reach space is about 16 inches; the extended reach space, about 24 inches. All frequently used controls (transceiver, keyer, keyboard, etc.) should be within the maximum reach space with your arms extended. Bending or leaning forward for controls leads to excessive fatigue.

The Station Table

The height of your station table or desk is a key dimension. The simplest way to describe it is that the table height should be about elbow height when you are sitting comfortably with your feet on the floor, arms hanging vertically from the shoulder. For most adults this is in the range 25 to 30 inches (635 to 762 mm). This allows you to rest your forearm on the table for keying or tuning. If your table is too high, you'll have to lift your arms to reach over the table. If it's too low, you'll be bending forward. The effect of working at elbow height (give or take a few inches) is to minimize fatigue to the back, shoulders, and arms.

Keeping your hand, wrist, and forearm in a straight line (the neutral wrist position) is the best posture for repetitive actions such as keying. Try to have the front edge of the table rounded or padded. Leaning your wrists or forearms on a 90-degree corner for long periods actually can damage the nerves and tendons leading to your fingers. Likewise, any other surfaces or tools you lean on or grip a lot should have at least a half-inch (127 mm) radius of cushioning. If your station desk has a sharp corner at the front edge, you can use homemade or store-bought padding. One such product is SoftEdge, available from AliMed at 1-800-225-2610 or <http://www.alimed.com>.

Many hams use a desk or table that

"Keeping your hand, wrist, and forearm in a straight line (the neutral wrist position) is the best posture for repetitive actions such as keying."

is 36 inches (91 cm) or more wide. This is good for equipment that is deep (front to back), such as computer monitors and scopes. However, if you place your operating equipment at the back of a 36 inch desk, there will be a wide space in front where you must lean or reach across to the controls. Your most efficient work area, industrial engineers have found, is the area directly in front of your body where your forearms and hands can reach easily. Your keyer paddles, push-to-talk switch, tuning knob and other frequently used items should be in this area. The second best area is where you can reach from your shoulder, using your whole arm without leaning forward. Switches and instruments you use less often should be in this area.

Seating Arrangements

While your headphones are your interface with audio, your chair is the inter-

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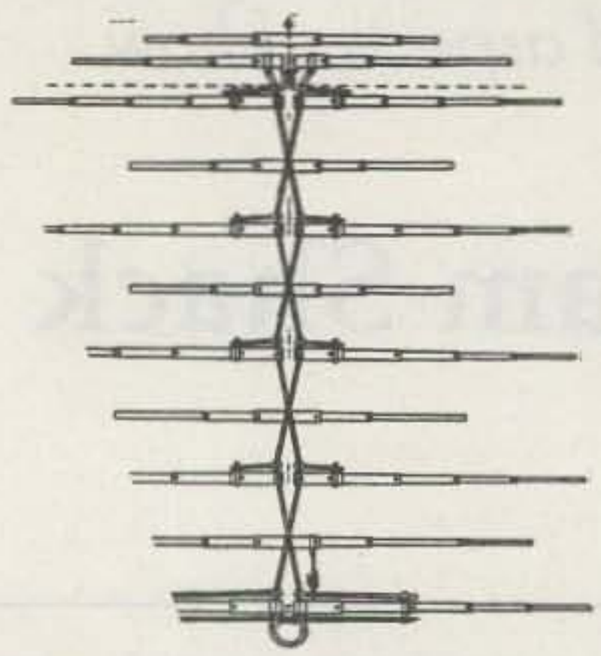

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Portable Gear Guidelines

Operating portable, while camping, at Field Day, or at other special events is both fun and good practice for emergencies. But one thing emergency coordinators don't need is another casualty, such as a ham injured while moving equipment. Human- factors research gives us some guidelines about manual handling and setup safety:

- Limit the weight of any one container or rig to 35 pounds (16 kg) maximum if it must be picked up and carried. Planning to use two people to carry is wishful thinking under emergency conditions.
- Locate handles so the equipment will be balanced when you pick it up. Label containers with the weight and center of gravity to avoid surprises when they are lifted.
- Use handles large enough to be grasped with gloves on. The "D" handle should be at least 4.2 inches long by 1.5 inches wide (10.7 by 2.5 cm). The handle itself should be curved or padded with a radius of 0.5 inches (1.3 cm) so it doesn't cut into your hand.
- Store containers on shelves or racks about knuckle height (28–36 inches, or 73–92 cm) where possible. This way you can pick them up in a straight-arm carry with little or no lifting. Avoid storing heavy equipment where you will have to bend to the floor or reach above shoulder height.
- Mount wheels on equipment when feasible, or use a two-wheel dolly or luggage carrier for moving. Larger wheels go over rough ground easier; 6 inch (15 cm) diameter is good.
- Label each equipment container on top or where it opens. An inventory of what's inside is even better. Make sure labels are weatherproof.
- Label electrical connections with voltage, phase, frequency, and polarity as appropriate.
- Use standard power and antenna cables and connectors where possible. *The ARRL Handbook* suggests MOLEX Series 1545 connectors (RadioShack Cat. No. 274-222) for portable VHF/UHF equipment DC power cables.
- Include an instruction summary sheet in a plastic cover, plus a kit of spares such as fuses, bulbs, cable adapters, and manuals.

face between your buttocks and gravity. Almost all chair manufacturers now call their chairs "ergonomic," so they must be good, right? Unfortunately, there is no industry standard for this term. It's like "affordable." If you can afford it, it's affordable. Likewise, if the chair fits you well, it's ergonomic. If you're shopping for a new (or used) chair, determine for yourself what features are important.

"Your viewing angle to the transceiver can make a big difference in the condition of your neck after long hours of operating. "

Setting the chair height is important, but a pneumatic cylinder for height adjustment may not be needed if you are the only user and you only set it once. The backrest should be wide and high enough for you, with the lumbar support right against the curve of your lower back. The padding should be firm enough to distribute the pressure from long hours of sitting. Key dimensions for seating are the length of your upper legs and the width of your hips and buttocks. If you are much shorter, longer, or wider than average here, find a chair with a seat pan (the part you sit on) to match.

If you have the computer or other equipment to your side, a swivel chair avoids the need to twist your back over and over to reach it. Decide if you like casters on the chair, or if you would be more comfortable with a chair that stays put. If your legs are short, or if you find it hard to sit back in the chair, a footrest can be of help.

Line of Sight

Your viewing angle to the transceiver can make a big difference in the condition of your neck after long hours of operating. Ideally, you should be able to sit upright and see the frequency and other displays as if you were reading a book. If you have to crouch or bend your neck to see, you're asking for tired or cramped neck muscles. Recent research says that the optimal location of visual targets is at least 15 degrees below horizontal eye level. A ham's primary visual targets are probably the transceiver frequency display and the computer screen.

Many transceivers have a hinged wire support or other gadget to lift the front toward your line of sight. The downside of this design is that it raises the front panel above the table surface so you can't rest your forearm while tuning. By constructing a sloped shelf at

the back of the operating table, you can position your transceiver and other rigs to be at right angles to your line of sight and keep the tuning knob close to the main table surface. To determine the angle, measure the right triangle with the height your eye-height above the table and the base the distance from the edge of the table to the transceiver.

Setting the computer-screen height is usually easier. Unless you're very tall, you probably don't want to place the computer monitor on top of the computer processing and disk drive unit. If you need to raise the monitor only a few inches, a small shelf will do that and allow space underneath for the keyboard or paperwork. If you wear bifocals, the monitor should be as low as possible, since you're looking through the lower part of the lenses for short range. Otherwise you'll have to tip your head back to see the screen.

If you're doing a lot of messaging or data entry with the keyboard, try to have it low enough for a neutral wrist position. For the least stressful typing position your upper arms would be at your sides with your elbows bent 90 degrees. Your forearms would be level and wrists straight as the fingers rest on the keys. For most people this position requires that the keyboard and mouse surface be about 25 to 28 inches above the floor, almost like in your lap. A higher keyboard leads to fatigue by making you lift your arms or wrists, or lean your whole body forward.

Mistakes and Accidents

Error avoidance is part of human factors planning. The first priority is to prevent personal injury to yourself or to visitors. Second is to avoid damage to the equipment from problems such as reversed power supply polarity or keying a transmitter without an antenna attached. Safety engineers say you should try to anticipate hazards and take at least two steps to prevent them. Engineering controls are best; that means a prevention step that doesn't require human action. For example, we wire bleeder resistors in a power supply so we don't have to remember to ground the filter capacitors. Even though you're an experienced ham, help yourself by labeling and color coding cables, connectors, and switches. Mistakes often happen when you're short on sleep, have jet lag, just had a family argument, or are simply in a hurry. That's when a logical layout and clearly labeled controls and connections can make a difference. ■

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The Care and Feeding Of Analog Meters

And a Modern Way to Measure Their Internal Resistance

BY GEORGE MURPHY,* VE3ERP

There is something soothing about an analog meter. When anything changes, instead of a rapid progression of unreadable numbers on a frenetic digital display, you can watch the needle on an analog meter saunter to where the action is, settle down when the action stops, and tell you what you want to know. Analog meters hark back to the days when real radios glowed in the dark, real airplanes had propellers, and you knew what time it was from where Mickey Mouse's big analog hand and little analog hand were pointing. Trying to read the time (or anything else) on the digital display of a modern rig is frustrating. It is often akin to gazing into a plate of agitated alphabet soup.

*77 McKenzie St., Orillia, ON L3V 6A6, Canada
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Analog meters will be still be with us for a while. A glance at current advertisements for electronic equipment will show that where operating parameters are critical, measurements usually are still indicated on analog meters. This may be partly because an analog meter has a psychological characteristic a digital meter just does not have. The needle of an analog meter provides a constant subconscious awareness of its whereabouts with respect to both ends and the center of the scale. You may not realize it, but your mind reacts more to the location and angle of the needle than the numbers to which it points because you are too busy making sure it doesn't go anywhere foolish in its travels.

On the other hand, numeric digital displays provide no visual reference to indicate if the numbers you are looking at are relatively low, medium, or high. Suppose, for instance, you are tuning up for an SWR of 1.50, your digital meter reads 15.0, and you don't notice the tiny decimal point is in the wrong place. By the time you realize something is wrong, your rig has fried and your "better half" has dialed 911.

At some time or another many of us probably have needed to measure the internal resistance of an analog meter, usually in the course of extending the current range by adding a shunt resistor in parallel with the meter (necessitating, of course, a steady hand in drawing a new dial to suit!). To do this, the meter's internal resistance must be known to calculate the value of the shunt resistor. This applies to new meters as well as surplus units. Often the internal resistance is unknown (when the meter is purchased at a flea-market or is taken from a commercial

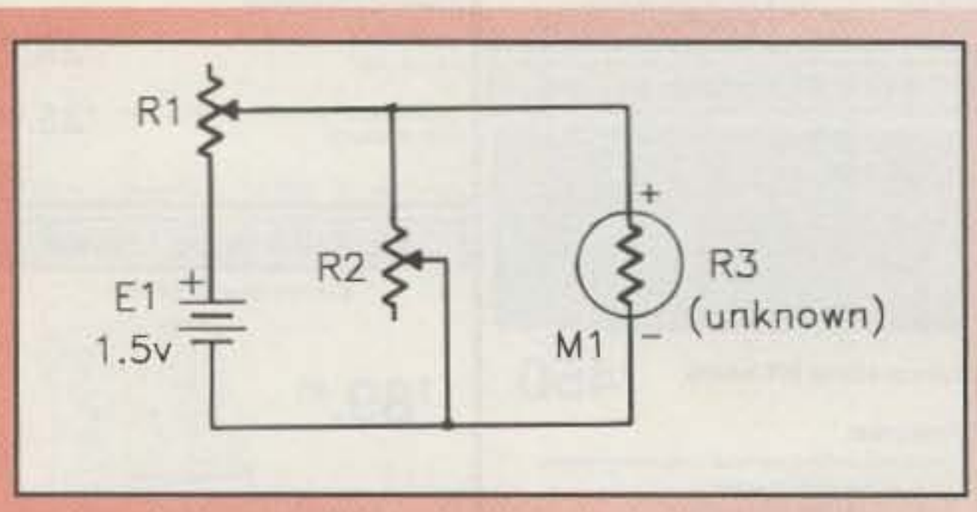

Fig. 1– The test circuit advocated by The ARRL Handbook *until about 1975. M1 is the meter whose internal resistance is being measured. (See text for details.)*

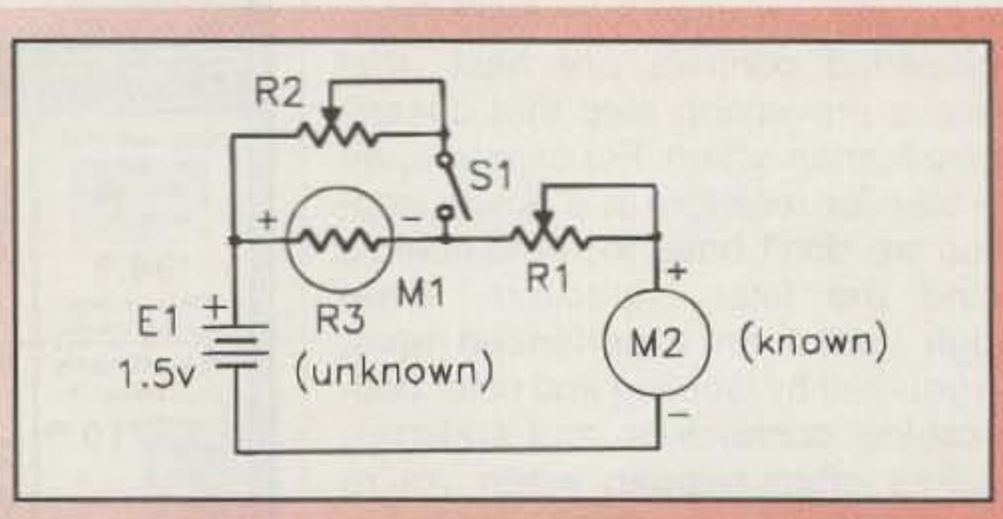

Fig. 2– Subsequent editions of The ARRL Handbook *now present this circuit, where M1 is the meter being measured and M2 is a known mA or µA meter. (See text.)*

Cct. Fig.	E1 v.	R3s mA	Rt ohms	Rn ohms	R1 ohms	I1 mA	V1 v.	R2 ohms	I2 mA	V2 v.	R3 ohms	I3 mA	V3 v.
a) 1	1.5	1.0	1500	500	1000	1.00	1.0	—	—	—	500	1.0	0.50
b) 1	1.5	1.0	1273	273	1000	1.18	1.18	600	.54	0.32	500	.64	0.32
c) 1	1.5	1.0	1250	250	1000	1.20	1.20	500	.60	0.30	500	.60	0.30
d) 1	1.5	1.0	1222	222	1000	1.23	1.23	400	.68	0.27	500	.55	0.27
e) 1	1.5	1.0	1200	200	1000	1.25	1.25	333	.75	0.25	500	.50	0.25
f) 1	1.5	1.0	1143	143	1000	1.31	1.31	200	.94	0.19	500	.37	0.19
g) 2	1.5	1.0	1500	500	1000	1.00	1.00	—	—	—	500	1.0	0.50
h) 2	1.0	1.0	1000	250	750	1.00	0.75	500	5.0	0.25	500	.50	0.25
i) 2	1.5	1.0	1500	250	1250	1.00	1.25	500	5.0	0.25	500	.50	0.25
j) 2	2.0	1.0	2000	250	1750	1.00	1.75	500	5.0	0.25	500	.50	0.25
k) 2	6.0	1.0	5000	250	4750	1.00	4.75	500	5.0	0.25	500	.50	0.25

R3s is the meter sensitivity (i.e., scale reads 0 to R3s).
Rt is the total resistance in the circuit.
Rn is the net resistance of R2 and R3 in parallel (Rn = 1/[1/R2+1/R3])
I1, I2, & I3 are the currents through R1, R2, & R3.
V1, V2, & V3 are the voltage drops across R1, R2 and R3

a) shows R2 disconnected and R1 adjusted for fu11 scale reading on R3.
b) to f) show changing values as R2 is adjusted.
c) shows condition when R2 = R3. I2 = I3 but R3 does not read exactly half scale.
e) shows condition where R3 reads exactly half scale. I2 does not equal I3.

g) shows R2 disconnected and R1 adjusted for full-scale reading on R3.
h) to k) show some of the endless combinations of E1, R1, and R2, where R2 = R3.

Table I– The math.

piece of equipment, for example). Unfortunately, the internal resistance cannot be measured directly with an ohmmeter without risk of damage to the meter movement.[1]

A Brief History of Meter Measurement Techniques

Up until about 1975, *The ARRL Handbook for Radio Amateurs* advocated the test circuit shown in fig. 1, where M1 is the meter whose internal resistance is being measured. The measurement procedure called for removing R2 from the circuit, adjusting R1 for a full-scale reading on M1, then inserting R2 and adjusting it for an exact half-scale reading on M1. It is assumed that R2 is equal to the internal resistance R3 of the meter and R2 is removed from the circuit and measured separately.

In 1975 Zeb Rike, K5BBN, pointed out[2] an inherent pitfall in this method which could produce sizable errors, resulting from assuming the total current drawn from the battery does not change when R2 is connected. In actual fact, as soon as R2 is connected, the net resistance of R2 and R3 in parallel is less than R3 alone, so the current through R3 increases, as does the reading. As R2 is being adjusted to bring the reading back to half scale, the current changes constantly according to the changing net resistance of R2 and R3 in parallel. As R2 is adjusted, different amounts of current flow through R2 and R3, until a point is reached where the current through R3 is equal to one half its scale reading. At this point the current through R2 can be quite different from the current through R3, resulting in R2 having a different ohmic value than R3. Therefore, measuring R2 on the assumption its value is the same as R3 is erroneous. In his article, K5BBB indicated the magnitude of the error could be reduced by altering the battery voltage and/or the value of R1, and he presented an excellent nomograph for pre-determining accuracy of meter resistance measurements. Among other things, the nomograph clearly showed

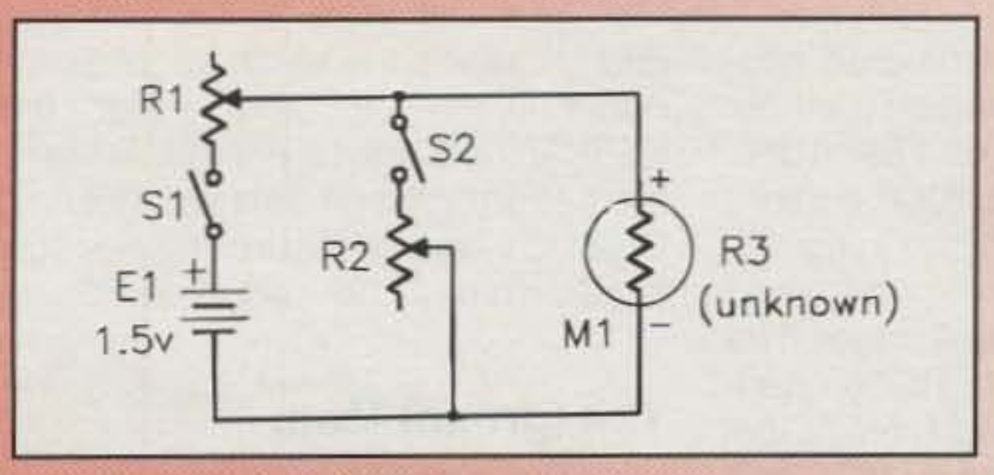

Fig. 3– The circuit of fig. 1 with linear potentiometers and switches added for convenience.

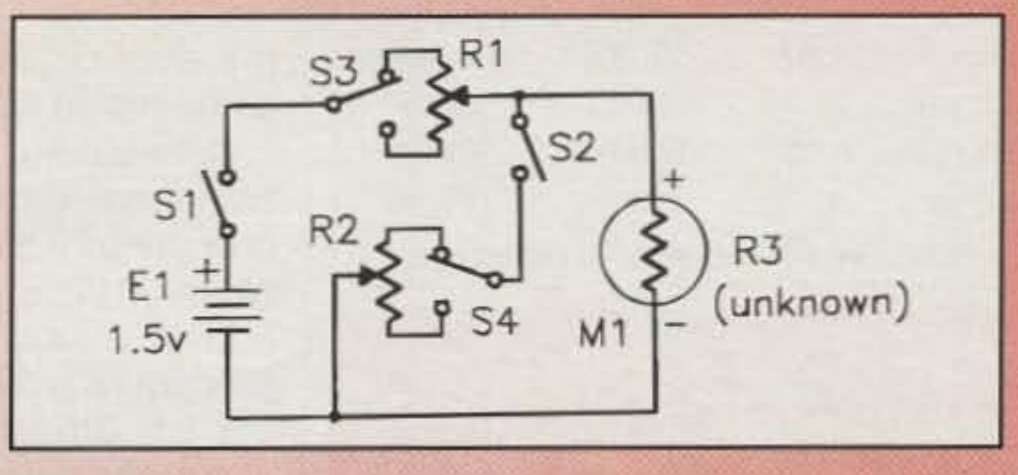

Fig. 4– The circuit of fig. 1 with audio potentiometers and switches.

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110 PRINT
120 PRINT "COMPUTED DATA:"
130 R3=0:N=10
140 '
150 R3=R3+N
160 RX=1/(1/R2+1/R3) 'net resistance of R2 and R3 in parallel
170 RT=R1+RX 'total series resistance
180 I1=E1/RT 'circuit current
190 I2=I1-I3 'current thru R2
200 V1=R1*I1 'voltage drop across R1
210 V2=R2*I2 'voltage drop across R2
220 V3=R3*I3 'voltage drop across R3
230 DIF=ABS(V2-V3)
240 IF DIF<.0001 THEN 290
250 IF V2>V3 THEN 270
260 R3=R3-N:N=N/10
270 GOTO 150
280 '
290 PRINT USING "Meter sensitivity= ##.# Kohm/volt";1/S
300 PRINT
310 PRINT USING "R3= ####.## ohms";R3;
320 PRINT SPC(1)"(internal resistance of meter)"
330 PRINT USING "Rn= ####.## ohms";RX;
340 PRINT SPC(1)"(net resistance of R2 and R3 in parallel)"
350 PRINT USING "Rt= ####.## ohms";RT;
360 PRINT SPC(1)"(total series resistance = R1 + Rn)"
370 PRINT
380 PRINT USING "I1= ####.## mA";I1*10^3;
390 PRINT SPC(3)"(current thru R1)"
400 PRINT USING "I2= ####.## mA";I2*10^3;
410 PRINT SPC(3)"(current thru R2)"
420 PRINT USING "I3= ####.## mA";I3*10^3;
430 PRINT SPC(3)"(current thru R3)"
440 PRINT
450 PRINT USING "V1= ####.## v.";V1;
460 PRINT SPC(3)"(voltage drop across R1)"
470 PRINT USING "V2= ####.## v.";V2;
480 PRINT SPC(3)"(voltage drop across R2)"
490 PRINT USING "V3= ####.## v.";V3;
500 PRINT SPC(3)"(voltage drop across R3)";
510 PRINT
520 END
```

Fig. 5– VE3ERP's BASIC program which does the fiddling with R1 and R2 for you.

the error could not be eliminated altogether using this measurement method.

Subsequent editions of *The ARRL Handbook* (including the 2000 edition) now present the circuit shown in fig. 2[3], where M1 is the meter being measured and M2 is a known mA or µA meter. The procedure is to disconnect R2 by opening S1, adjust R1 until M1 reads full scale, and note the reading on M2. Then connect R2 and alternately adjust R1 and R2 until M1 reads exactly half scale, and M2 reads the same value as in the previous step. In other words, follow K5BBN's advice to twiddle R1 and/or the battery voltage until you get it right. Open S1 and measure the resistance of R2, which is now equal to R3.

The (groan) Math

Let's look at what goes on in the circuits shown in figs. 1 and 2. Table I shows conditions for a meter with a sensitivity

of 1 mA (1 KΩ/volt) and an internal resistance of 500 ohms (which you don't know yet). The values in the table have been rounded off.

Observations:

1. (e) illustrates the inherent error pointed out by K5BBN. At one-half scale reading on M1, R2 does not equal R3, and I2 does not equal I3, although the voltage drop across each is the same.

2. In (b) to (f) it is important to note that in all cases V2 = V3.

3. For purposes of comparison, the internal resistance of meter M2 has been ignored in lines (g) to (k) of the table. *The ARRL Handbook* does not discuss it, but in actual practice the internal resistance of M2 may alter (perhaps by a considerable factor) the values shown. If such is the case, *The Handbook* advises to use no more supply voltage than necessary.[4]

My Problem

I have a problem with the ARRL method of measurement for several reasons:

1. Accuracy is dependent upon my memory, manual dexterity, and visual acuity in getting M2 to read *exactly* the same under two different sets of conditions. This is difficult for me, especially when the needle on M2 points somewhere between gradation marks on the scale.

2. The alternate fiddling with R1 and R2 should not be necessary, especially when you can never be quite sure when you have it right.

3. It should not be necessary to change the supply voltage.

4. The circuit is too complicated and the testing procedure is too awkward for impatient, absent-minded, shaky, bleary-eyed, grumpy old guys like me.

5. I much prefer the original fig.1 circuit, with switches added for convenience as shown in fig. 3 (with linear potentiometers), or fig. 4 (with audio potentiometers).[5] An advantage of logarithmic taper audio pots is the ability to alter the sensitivity of response over any given range of adjustment by "switching ends." For starters, try using 5K pots, as they are easy to find and should do the job in most instances.

My Solution

The fiddling with R1 and R2 in the fig. 2 method indicates an iterative process, similar to adjusting the Tune and Load controls in tuning a Pi network. Modern antenna transmatches (a.k.a. *antenna tuners* to the "unwashed") do this automatically using computer technology,

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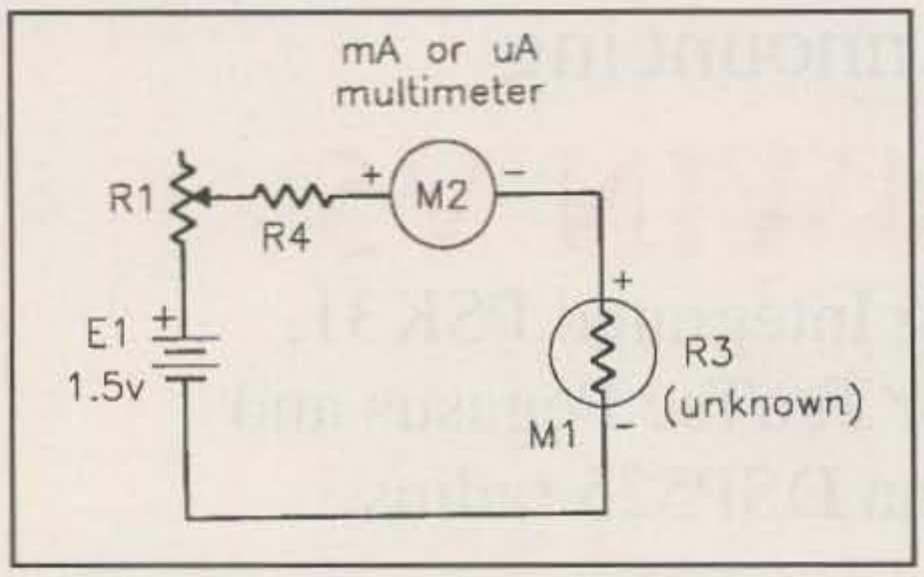

Fig. 6– If the meter is not marked as to the full-scale current of M1, you will have to measure the sensitivity.

Fig. 7– Running the BASIC program shown in fig. 5 will result in a readout similar to this, which shows the solution to the meter cited in Table I. →

```
ANALOG METER INTERNAL RESISTANCE CALCULATOR

INPUT DATA:
Meter full scale current (mA).....? 1
Measured test cct. voltage .....? 1.5
Measured value of R1 (ohms).....? 1000
Measured value of R2 (ohms).....? 333.33

COMPUTED DATA:
Meter sensitivity = 1.0 Kohm/volt

R3 =   500.00 ohms   (internal resistance of meter)
Rn =   200.00 ohms   (net resistance of R2 and R3 in parallel)
Rt =   1200.00 ohms  (total series resistance = R1 + Rn)

I1 =   1.25 mA       (current thru R1)
I2 =   0.75 mA       (current thru R2)
I3 =   0.50 mA       (current thru R3)

V1 =   1.25 v.       (voltage drop across R1)
V2 =   0.25 v.       (voltage drop across R2)
V3 =   0.25 v.       (voltage drop across R3)
Ok
```

so why not use my computer to do the fiddling? I wrote a BASIC program (fig. 5)[6] to do just that.

You will need to know the full-scale current (sensitivity) of M1 in mA. This is usually indicated somewhere on the meter as either "0-X mA" (where sensitivity in mA = X), or "0-Y μA" (where sensitivity in mA = Y/1000), or "Z KΩ/ volt" (where sensitivity in mA = 1/Z). If the meter is not marked, you will have to measure the sensitivity (fig. 6). Use a multimeter with a sensitivity of at least 20 KΩ/v. Make sure the value of R4 is sufficient to prevent damage to the meters. Adjust R1 until M1 reads full scale, and then read its sensitivity on the multimeter.

How to Find Internal Resistance

Referring to figs. 3 and 4:

1. Open S1 and S2, and set R1 and R2 to maximum resistance.
2. Insert M1 and close S1.
3. Reduce R1 until M1 reads exactly full scale.
4. Close S2 and reduce R2 until M1 reads exactly half scale.
5. Measure E1 (under load) with an accurate multimeter.
6. Open S1 and S2, and remove M1.
7. Measure R1 and R2 with the same multimeter used in step (5).

When you have determined the sensitivity of M1 and the values of R1, R2, and E1, run the BASIC program shown in fig. 6. You will get a readout similar to that shown in fig. 7[7], which shows the solution to the meter cited in "The Math" example, Table I.

How The Computer Does It

The key to the solution is Observation 2 above: V2 must equal V3, or as far as the computer is concerned, be so close the difference is not discernible. The values of E1, R1, R2, and the meter full-scale current having been fixed by your data input, the trick is to find a value of R3 where it all comes together. The calculation starts with a bare minimum value for R3 and calculates the many variables involved, including V2 and V3. If V2 is not within 0.0001v of V3, R3 is increased ever so slightly, and the process repeats over and over with ever-increasing values of R3 until V2 and V3 are within 0.0001v of each other. Then the computer displays the results. All this takes a fraction of a second on a modern computer. Occasionally, if you enter some ridiculous values (typographical error, of course!), the computer may seem to hang up. If you wait a few seconds, when you see the results you will realize that it took hundreds of thousands of calculations to produce the wildly erratic solution to your totally silly problem. Don't blame the computer. It was only doing what it was told!

And *Finally . . .*

I wish to expose Curt Thompson, VE3HML, as being guilty of encouraging me to get into things like this by making me aware of information he knows will goad me out of my comfortable armchair and back to *work*, from which I am supposed to be retired.

Now that I have things straightened out, I am about to return to my comfortable armchair to contemplate the current technological furor over digits, and why each of Mickey Mouse's analog hands on my watch seems to be missing one.

References

1. *The ARRL Handbook for Radio Amateurs,* p. 26.4.

2. Zeb Rike, K5BBN, "Measuring Meter Resistance," *QST,* Feb. 1975, pp. 52 and 73.

3. *The 2000 ARRL Handbook,* fig. 26.2, p. 26.4.

4. The 2000 ARRL Handbook, p. 26.5.

5. G. Murphy, VE3ERP, "Custom Potentiometers From Your Junkbox," *CQ,* July 1999, p. 29.

6. The BASIC program shown in fig. 6 is an excerpt from "HAMCALC—Painless Math for Radio Amateurs," version 41. If you don't have this computer freeware, you are missing out on the best freebee offer since I tried to give away square wheels. For a free copy, send $6.00US (to cover cost of materials and airmail shipping) to me at the address shown at the beginning of this article. It comes on two 3½ inch floppies, complete with documentation, and runs in either MS-DOS or Windows.

7. Fig. 7 is a "print screen" printout of the screen display produced by the BASIC program in fig. 6. ■

Announcing:

The 43nd Annual CQ World-Wide WPX Contest

SSB: March 24–25, 2001 CW: May 26–27, 2001

Starts: 0000 GMT Saturday Ends: 2400 GMT Sunday

I. Contest Period: Only 36 hours of the 48 hour contest period permitted for Single Operator stations. Off periods must be a minimum of 60 minutes in length and clearly marked in the log. Listening time counts as operating time. Multi-Operator stations may operate the full 48 hours.

II. Objective: Object of the contest is for amateurs around the world to contact as many amateurs in other parts of the world as possible during the contest period.

III. Bands: The 1.8, 3.5, 7, 14, 21, and 28 MHz bands may be used. No WARC bands.

IV. Types of Competition (for all categories): All entrants must operate within the limits of their chosen category when performing any activity that could impact their submitted score. Transmitters and receivers must be located within a 500 meter diameter circle or within the property limits of the station licensee, whichever is greater. All antennas must be physically connected by wires to the transmitters and receivers used by the entrant. Only the entrant's callsign can be used to aid the entrant's score.

1. Single Operator (Single Band and All Band)

(a) Single operator stations are those at which one person performs all of the operating, logging, and spotting functions. Only one transmitted signal is allowed at any time.

(b) Low Power: Same as 1(a) except that output power **shall not exceed 100 watts**. Stations in this category will compete with other low power stations only.

(c) QRP/p: Same as 1(a) except that output power shall not exceed 5 watts. Stations in this category will compete with other QRP/p stations only.

(d) Assisted: Same as 1(a) except the passive use (no self-spotting) of DX spotting nets or other forms of DX alerting are permitted. Stations in this category will compete with other Assisted stations only.

(e) Tribander/Single Element (TS): Tribander (any type) with a single feedline from the transmitter to the antenna and single element (TS) category. During the contest, an entrant shall use only one (1) tribander for 10, 15, 20 meters and single-element antennas on 40, 80, and 160.

(f) Band Restricted (BR): An eligible entrant must hold a license restricting operation to less than the six (6) contest bands (160, 80, 40, 20, 15, 10) on both modes. Examples of such licenses are: Novice, Technician, 4 class license, etc. Since frequency privileges differ from country to country, competition is within one's own country.

(g) Rookie (R): An entrant in this category shall have been licensed as a radio amateur three (3) years or less.

2. Multi-Operator (All band operation only)

(a) Single-Transmitter: Only one transmitter and one band permitted during the same time period (defined as 10 minutes). **Exception: One—and only one—other band may be used during any 10-minute period if—and only if—the station worked is a new multiplier. Logs found in violation of the 10-minute rule will be automatically reclassified as multi-multi.**

(b) Multi-Transmitter: No limit to transmitters, but only one signal and running station allowed per band. Note: All transmitters and receivers must be located within a 500 meter diameter area or within property limits of the station licensee, whichever is greater. All operation must take place from the same operating site.

V. Exchange: RS(T) report plus a progressive contact three-digit serial number starting with 001 for the first contact. (Continue to four digits if past 999.) **Multi-operator multi-transmitter stations use separate serial numbers for each band.**

VI. Points:

(a) Contacts between stations on different continents are worth three (3) points on 28, 21, and 14 MHz and six (6) points on 7, 3.5, and 1.8 MHz.

(b) Contacts between stations on the same continent, but different countries, are worth one (1) point on 28, 21, and 14 MHz and two (2) points on 7, 3.5, and 1.8 MHz. **Exception: For North American stations only—contacts between stations within the North American boundaries (both stations must be located in North America) are worth two (2) points on 28, 21, and 14 MHz and four (4) points on 7, 3.5, and 1.8 MHz.**

(c) Contacts between stations in the same country are worth 1 point regardless of band.

VII. Multiplier: The multiplier is the number of "valid" prefixes worked. A PREFIX is counted only once regardless of the number of times the same prefix is worked.

(a) A PREFIX is the letter/numeral combination which forms the first part of the amateur call. Examples: N8, W8, WD8, HG1, HG19, KC2, OE2, OE25, etc. Any difference in the numbering, lettering, or order of same shall constitute a separate prefix. A station operating from a DXCC country different from that indicated by its callsign is required to sign portable. The portable prefix must be an authorized prefix of the country/call area of operation. In cases of portable operation, the portable designator will then become the prefix. Example: N8BJQ operating from Wake Island would sign N8BJQ/KH9 or N8BJQ/NH9. KH6XXX operating from Ohio must use an authorized prefix for the U.S. 8th district (W8, K8, etc.) Portable designators without numbers will be assigned a zero (0) after the second letter of the portable designator to form the prefix. Example: N8BJQ/ PA would become PAØ. All calls without numbers will be assigned a zero (Ø) after the first two letters to form the prefix. Example: XEFTJW would count as XEØ. Maritime mobile, mobile, /A, /E, /J, /P, or interim license class identifiers do not count as prefixes.

(b) Special event, commemorative, and other unique prefix stations are encouraged to participate. Prefixes must be assigned by the licensing authority of the country of operation.

VII. Scoring:

1. Single Operator: (a) All Band score = total QSO points from all bands multiplied by the number of different prefixes worked (prefixes are counted only once). (b) Single band score = total QSO points on the band multiplied by the number of different prefixes worked.

2. Multi Operator: Scoring is the same as Single Operator, All Band.

3. A station may be worked once on each band for QSO point credit. Prefix credit can be taken only once.

IX. QRP/p Section: Single Operator only. Output power must not exceed 5 watts. You must denote QRP/p on the summary sheet and state the actual maximum output power used for all claimed contacts. Results will be listed in a separate QRP/p section and certificates will be awarded to each top-scoring QRP/p station in the order indicated in Section XI.

X. Low Power Section: Single Operator only. Output power must not exceed 100 watts. You must indicate low power on the summary sheet and state the actual maximum output power used for all claimed contacts. Results will be listed in a separate low power section and certificates will be awarded to each top-scoring low power station in the order indicated in Section XI.

XI Awards: Certificates will be awarded to the highest scoring station in each category listed under Section IV—

1. In every participating country

2. In each call area of the United States, Canada, Australia, and Asiatic Russia.

All scores will be published. To be eligible for an award, a single operator station must show a minimum of 12 hours of operation and multi-operator stations must show a minimum of 24 hours of operation.

A single band log will be eligible for a single

band award only. If a log contains more than one band, it will be judged as an all band entry unless specified otherwise.

In countries or sections where entries justify, second- and third-place awards will be made.

XII. Trophies, Plaques, and Donors:

SSB

Single Operator, All Band

WORLD – Stanley Cohen, WD8QDQ
USA – Atilano de Oms, PY5EG
EUROPE – Jim Hoffman, N5FA
SOUTH AMERICA – Ron Moorefield, W8ILC
OCEANIA – Phillip Fraizer, K6ZM Memorial
AFRICA – Peter Sprengel, PY5CC
JAPAN – The DX Family Foundation
WORLD Low Power – Steve Bolia, N8BJQ
USA Low Power – Oklahoma DX Association
CANADA Low Power – Amateur Radio League of Alberta
WORLD QRP/p – Dayton Amateur Radio Association
USA QRP/p – Doug Zwiebel, KR2Q

Single Operator, Single Band

WORLD – John N. Reichert, N4RV
WORLD 28 MHz – Alan Dorhoffer, K2EEK Memorial
WORLD 7 MHz – William D. Johnson, KVØQ
WORLD 3.7 Low Power – Nilay & Berkin Aydogmus, TA3YJ & TA3J
OCEANIA –D. Craig Boyer, AH9B
USA 28 MHz Novice/Tech – Jon Engelhardt, KAØZFX
USA 21 MHz – Bernie Welch, W8IMZ Memorial
USA 3.7 MHz – Lance Johnson Digital Graphics
USA 14 MHz Low Power – Boomer Contest Club

Multi-Operator, Single Transmitter

USA – D. Craig Boyer, AH9B

Multi-Operator, Multi-Transmitter

NORTH AMERICA – Burt Curwen, KL7IRT Memorial

Contest Expedition

WORLD – Kansas City DX Club

CW

Single Operator, All Band

WORLD – Steve Bolia, N8BJQ
USA – Dennis Motschenbacher, K7BV
EUROPE – Ivo Pezer, 5B4ADA/9A3A
OCEANIA – Tom Morton, K6CT
CANADA – Radio Amateurs of Canada (RAC)
JAPAN – The DX Family Foundation
WORLD LOW POWER – Steve Bolia, N8BJQ
USA LOW POWER – Ron Stark, KU7Y
CANADA LOW POWER – Amateur Radio League of Alberta
ZONE 3 High Power – Jim Pratt, N6IG

Single Operator, Single Band

WORLD – Pedro Piza, Sr., KP4ES Memorial
WORLD 7 MHz – William D. Johnson, KVØQ
WORLD 3.5 MHz – Lance Johnson Digital Graphics
OCEANIA – D. Craig Boyer, AH9B
USA – Kansas City DX Club
USA 28 MHz – Bernie Welch, W8IMZ Memorial
USA 21 MHz – Wayne Carroll, W4MPY

Multi-Operator, Single Transmitter

WORLD – Ron Blake, N4KE
USA – Austin Regal, N4WW

Multi-Operator, Multi-Transmitter

USA – Oklahoma DX Association

Contest Expedition

WORLD – Steve Bolia, N8BJQ

Combined SSB/CW

Single Operator, All Band

WORLD – Al Slater, G3FXB Memorial
EUROPE – Les Nouvelles DX Group
USA – D. Craig Boyer, AH9B

Club (SSB & CW)

WORLD – CQ Magazine
USA – Oklahoma DX Association

A station winning a World trophy will not be considered for a sub-area award. That trophy will be awarded to the runner-up for that area if the returns justify the award.

XIII. Club Competition: A trophy will be awarded each year to the club or group that has the highest aggregate scores from logs submitted by members. The club must be a local group and not a national organization. Participation is limited to members operating within a local geographical area (exception: DXpeditions specially organized for operation in the contest and manned by members). Indicate your club affiliation on the summary sheet. To be eligible for an award, a minimum of three logs must be received from a club.

XIV. Log Instructions:

(a) All times must be in GMT. All breaks must be clearly marked. Single operator and multi-single logs must be submitted in chronological order. Multi-multi logs must be submitted chronologically by band.

(b) All sent and received exchanges are to be logged.

(c) Prefix multipliers should be entered only the FIRST TIME they are worked.

(d) Logs must be checked for duplicate contacts, correct QSO points, and prefix multipliers. Duplicate contacts must be clearly shown. Computerized logs must be checked for typing accuracy. Original logs may be requested if further cross-checking is required.

(e) An alpha/numeric check list of claimed PREFIX multipliers must be submitted with your log.

(f) Each entry must be accompanied by a Summary Sheet listing all scoring information, the category of competition, and the entrant's name and mailing address in BLOCK LETTERS. Also submit a signed declaration that all contest rules and regulations for amateur radio in the country of operation have been observed.

(g) Official log and summary sheets are available from *CQ* for an SASE with sufficient postage. If official forms are not available, you may make your own.

(h) Electronic submission of logs is encouraged, and in fact required for all top-scoring entrants and all who use a computer to log or prepare the logs. The CABRILLO format is preferred. Please insure that you fill out all of the header information, including your club affiliation. If you submit a CABRILLO log, no additional summary sheet is required. If you cannot submit a CABRILLO log, you may submit the ASCII output from most of the popular logging programs such as TR, CT, NA, Writelog and SuperDuper. You may also submit the *.BIN,*.DAT *.QDF files from CT, TR or NA. If the log is not in CABRILLO format, a separate summary sheet is required. Please name your files with yourcall and the file type. Example: N8BJQ submits a CABRILLO file. It should be named N8BJQ.CBR. If N8BJQ chose to submit a non CABRILLO file such as TR's .dat file, he should name the log file N8BJQ.DAT and the summary file should be N8BJQ.SUM. See the WPX web site for more information on email log formats. Logs sent on disk should be on 3.5" disks if possible.

(i) Logs may be submitted via e-mail to **<N8BJQ@ERINET.COM>**. Non-**CABRILLO** internet or disk submissions require a summary sheet as well as the log file. All logs received via e-mail will be confirmed via e-mail. A listing of logs received can be found on the CQ WPX website at **<http://ourworld.compuserve.com/homepages/n8bjq>** and will be updated frequently.

XV. Disqualification: Violation of amateur radio regulations in the country of the contestant, or the rules of the contest, unsportsmanlike conduct, taking credit for excessive duplicate contacts, unverifiable QSOs or multipliers will be deemed sufficient cause for disqualification. An entrant whose log is deemed by the WPX Contest Committee to contain a large number of discrepancies may be disqualified as a participant operator or station for a period of one year. If within a five-year period the operator is disqualified a second time, he will be ineligible for any CQ contest awards for three years.

The use of non-amateur means such as telephones, telegrams, packet, etc., to solicit contacts or multipliers during the contest is unsportsmanlike and the entry is subject to disqualification. Actions and decisions of the WPX Contest Committee are official and final.

XIII. Deadline:

(a) All entries must be postmarked NO LATER than **May 1, 2001** for the SSB section and **July 1, 2001** for the CW section. E-mail logs are also subject to these deadlines. **Indicate SSB or CW on your envelope**. One extension of up to 30 days, for legitimate reasons, may be granted if requested from the contest director. Logs postmarked after the deadline, or extension deadline if granted, may be listed in the results, but will be ineligible for any awards.

All logs go to: CQ WPX Contest, 25 Newbridge Road, Hicksville, NY 11801 USA. Questions pertaining to the WPX Contest may be sent to WPX Contest Director, Steve Bolia, N8BJQ, 7354 Thackery Road, Springfield, OH 45502 USA, or via e-mail to <n8bjq @erinet.com>.

Please remember to send in early for WPX contest log and summary sheets.

The WPX Home Page: <http://ourworld.compuserve.com/homepages/n8bjq>.

Reader Survey January 2001

We'd like to know more about you—about who you are, where you live, what kind(s) of work you do, and of course, what kinds of amateur radio activities you enjoy. Why? To help us serve you better.

Each time we run one of these surveys, we'll ask several questions and ask you to indicate your answers by circling numbers on the adjacent survey card and mailing it back to us. If the card is missing, just write your response numbers and the date of this issue on a postcard and mail it to *CQ* Reader Survey, 25 Newbridge Rd., Hicksville, NY 11801. We'll pick one respondent to each survey for a complimentary one-year *CQ* subscription (or renewal).

This month, with Phase 3D hopefully in orbit, we'd like to get your views on amateur satellites.

Please indicate... **Circle Survey Card #**

1. ... whether you have ever used amateur radio satellites to make one or more contacts
Yes 1
No 2

2. ... if you answered "Yes" to question 1, how often you use amateur radio satellites
Frequently (once a week or more) 3
Regularly (at least once a month or during contests) 4
Occasionally (up to a few times a year) 5
Rarely (less than once a year) 6

3. ... if you answered "No" to question 1, the main reason you've never tried satellite operating
Too complicated 7
Requires equipment I don't have or can't afford 8
No interest 9
Other 10

4. ... if you answered "No" to question 1, whether you'd like to try satellite operating in the future
Yes 11
No 12
Don't know 13

5. ... which <u>one</u> statement below most closely matches your feelings about amateur satellites
I use and enjoy them 14
I'm not a user, but feel they're important for ham radio's future 15
I'm not a user, but understand why other people enjoy them 16
I'm not a user; real radio signals bounce off the ionosphere 17
I don't know enough about them to choose 18

6. ... which of the following statements you agree with (choose as many as apply): Amateur satellites are...
The future of ham radio 19
A fun way to make contacts 20
A great educational tool 21
A great way for VHF-only hams to work DX 22
Too complicated for me 23
OK, but require equipment I don't have 24
Something I'd like to try in the future 25
Not something that interests me 26

7. ... whether you actively support the amateur satellite program
Yes, member of AMSAT 27
Yes, through ARRL (or similar) membership 28
No 29

Thank you for your responses. We'll have more questions for you in our next survey.

Oops...

Well, we blew it big-time with our November Reader Survey. Many of you noticed some of the problems, but others were less obvious (actually, it was a test of your ham ingenuity; some of you passed, some of you didn't). Here's what happened: As of the November issue, we made a few changes in the way we collect our survey data, including having the responses sent directly to the *CQ* offices instead of an outside processor. But... we had a few communication breakdowns along the way. First of all, there was a stock of the old cards left on a shelf at the printer's, and some folks there, trying not to be wasteful, decided to use them up before starting the new ones. Unfortunately, those had the wrong address on them. Next, on those issues in which the new card *was* inserted, the survey numbers didn't match up with the numbers on the response card. Many of you figured out ways around that problem. However, it seems that most of the newsstand copies had the old cards in them, so virtually all of the responses we got were from subscribers. Because of this, the survey responses are not representative of all of our readers, and we can't consider them valid. If we manage to get the ones that went to the wrong place, we may be able to come up with valid results in the future. In the December survey we got the numbers to match, but ended up with two number 13s (see, it *is* an unlucky number!) Hopefully, we've gotten everything straightened out as of this issue.

Also, in our November issue there was a typographical error in the article, "Low-Impedance, Parallel, Square-Conductor Transmission Lines," by VE3ERP (p. 60). In the equations at the very beginning of the article, the formula for "D" should have been $1.18 \times W$, not $1.8 \times W$ as printed.

In the December issue, we forgot to tell you where Santa was stocking up on gifts for good little hams when Staff Photographer Larry Mulvehill, WB2ZPI, snapped his picture for the cover. He was at Amateur Electronic Supply in Orlando, Florida, being helped by "elf" Charity Taylor, KF4RQY. Plus, if you were looking for the "Op Ed" column in December, you didn't find it. A last-minute change forced us to rearrange things and it got squeezed out,too late though to change the table of contents. Hopefully, it made it into this issue. We also accidentally forgot to credit two hams who provided photos for the "Public Service" column. The photo on page 68 was taken by Martin Mendelson, N1JMA; the photo on page 71 is by Christopher Post, N3SIG. Thank you to both, and to all who provide us with information and photos for our columns. Finally, "Our Readers Say" was actually on page 117, another victim of last-minute rearranging. We apologize for any inconvenience.

CQ Reviews:

The ICOM IC-718 HF Transceiver

BY DAVE INGRAM,* K4TWJ

What would you consider more fun and exciting than chatting with good friends and working DX with a room full of fancy gear? How about doing it with a brand-new, low-cost HF transceiver that is small enough to sit on a nightstand by your favorite easy chair and sports a number of big-rig features to boot?

Well, friends, that is exactly what I have been doing recently with ICOM's new IC-718, and I will bet a similar change of pace will add some new-found enjoyment to your life, too. How so? First, it is the famous old story of a special friend or a rare DX station that always hits the airwaves two minutes after you walk out of the shack or give up trying to copy weak, QRMed signals on a well-used and somewhat outdated transceiver. Second, there is unique radio magic in working the world with a neat little rig that must be experienced first hand to be fully appreciated.

Life is a one-shot deal. Why short-change yourself when new transceivers such as ICOM's IC-718 offer such high performance at such an attractive price?! The sunspot count is high, and the HF bands are better than they have been in a number of years. Get on the air and enjoy hamming to the max! I hear you asking, "What is special about the IC-718 and what makes it attractive for HFing?" That will take a few pages to explain, so be patient and read on!

Photo A– ICOM's new IC-718 packs a surprising amount of big-time performance into an exceptionally small case. The transceiver can also be tailored to your own operating preferences with optional accessories as discussed in text. (Photo courtesy ICOM America, Inc.)

Hey, Look Me Over!

Right from the first glance, the IC-718's 4" × 9.5" × 9" cabinet and front LCD-screen-type display produce a most favorable and "genuine ICOM" appearance (photo A). Indeed, the transceiver looks like a miniature IC-781, IC-746, or IC-756. Only three "official" knobs grace the front panel: AF and RF volume/squelch, RIT and IF Shift, and main tuning. Front push-buttons temporarily assign various other functions to the main tuning knob, however, producing the equivalent of a 30- or 40-knob rig.

Let's step back a minute and review The IC-718's basic attractions. The transceiver covers 160 through 10 meters with 5 to 100 watts output on CW and SSB (40 watts on AM), includes 300 kHz to 30 MHz shortwave reception, and sports 101 tunable memories. Additional specs and technical details are shown in fig. 1. Big-rig features include dual independent VFOs, split-frequency capability, band and memory scanning, SWR metering, VOX, speech compressor, semi and full QSK (break-in), CW keyer, and noise blanker. It strikes me as a lot of rig for the money, and its inclusion of a front-facing speaker plus SWR monitor and keyer results in a compact "one box unit" that fits almost anywhere. All you need to get on the air with an IC-718 is a microphone (a hand mic is supplied), key, antenna, and a 13 volt DC/ 20 amp (peak current) power supply or auto-mobile battery for mobiling or outbacking. The transceiver is fitted with a "standard" ICOM/Kenwood-type 6-pin DC socket, and the rear panel is flat without heat sink or fan protrusions.

Like other popular-model ICOMs, the IC-718's front-screen-type display indicates frequencies and modes in its upper area, while a bar-graph-type meter in its lower area indicates received signal levels, output power, SWR, and ALC (fig. 2). The bar graph also includes a peak hold function that freezes maximum level readings for approximately one second and makes them easy to read. Nice! When the IC-718's menu set is punched up, the display changes to indicate a selected feature or function, and adjustments are displayed on the bar graph as you rotate the tuning knob (fig. 3). This direct readout of selected adjustments is quite handy and user friendly, and it sure beats trying to remember the rig's full menu set or look it up in the manual during a QSO. That is not criticizing the manual; it is very

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Specifications of the ICOM IC-718 HF Transceiver

GENERAL

Frequency coverage:
Receive
0.03–29.999999 MHz*1
Transmit
1.800–1.999999 MHz*2
3.500–3.999999 MHz*2
7.000–7.300000 MHz
10.100–10.150000 MHz
14.000–14.350000 MHz
18.068–18.168000 MHz
21.000–21.450000 MHz
24.890–24.990000 MHz
28.000–29.700000 MHz

*1 Guaranteed range: 0.5–29.999999 MHz
*2 Varies according to version.

Mode: USB, LSB, CW, RTTY, AM
Number of memory channels: 101 (99 regular, 2 scan edges)
Frequency stability: Less than ±200 Hz from 1 min. to 60 min. after power on. After that, rate of stability less than ±30 Hz/hr. at +25°C (+77°F). Temperature fluctuations 0°C to +50°C (+32°F to +122°F) less than ±350 Hz.
Power supply requirement: 13.8 VDC ±15% (negative ground)
Current drain (at 13.8 VDC): Receive standby 1.3 A
Receive max. audio 2.0 A
Transmit max. power 20.0 A
Operatable temp. range: –10°C to +60°C; +14°F to +140°F
Antenna connector: SO-239 (50 ohms)
Dimensions: (projections not included) 240 (W) × 95 (H) × 239 (D) mm
$9^{7}/_{16}$ (W) × $3^{3}/_{4}$ (H) × $9^{13}/_{32}$ (D) in.
Weight (approx.): 3.8 kg (8 lb. 6 oz.)
ACC connector: 13-pin
REMOTE connector: 2-conductor 3.5 (d) mm (1/8 in.)

TRANSMITTER

Output power: SSB, CW, RTTY — 5–100 W
AM — 2–40 W
Modulation system: SSB — balanced modulation
AM — Low-level modulation
Spurious emissions: Less than –50 dB below peak output power
**Spurious freq.: below 30 MHz, –50 dB; above 30 MHz, –60 dB*
Carrier suppression: More than 40 dB
Unwanted sideband: More than 50 dB
Microphone connector: 8-pin (600 ohms)
Key connector: 3-conductor 6.5 (d) mm (1/4 in.)
SEND/ALC connector: Phono (RCA)

RECEIVER

Receive system: Double conversion superheterodyne system
Sensitivity: SSB, CW, RTTY
0.16 µV (1.8–29.999999 MHz)
AM
13 µV (0.5–1.799999 MHz)
2 µV (1.8–29.999999 MHz)
Squelch sensitivity: (threshold) SSB, CW, RTTY — less than 5.6 µV
Selectivity: SSB, CW, RTTY
More than 2.1 kHz/–6 dB
Less than 4.5 kHz/–60 dB
AM
More than 6 kHz/–6 dB
Less than 20 kHz/ –40 dB
Spurious and image rejection ratio: More than 70 dB (1.8–29.999999 MHz)
RIT variable range: ±1200 Hz
Audio output power: (at 13.8 VDC) More than 2.0 W at 10% distortion with an 8 ohm load
PHONES connector: 3-conductor 6.35 (d) mm (1/4 in.)
External SP connector: 2-conductor 3.5 (d) mm (1/8 in.)
8 ohm

Fig. 1– General technical specifications of the IC-718.

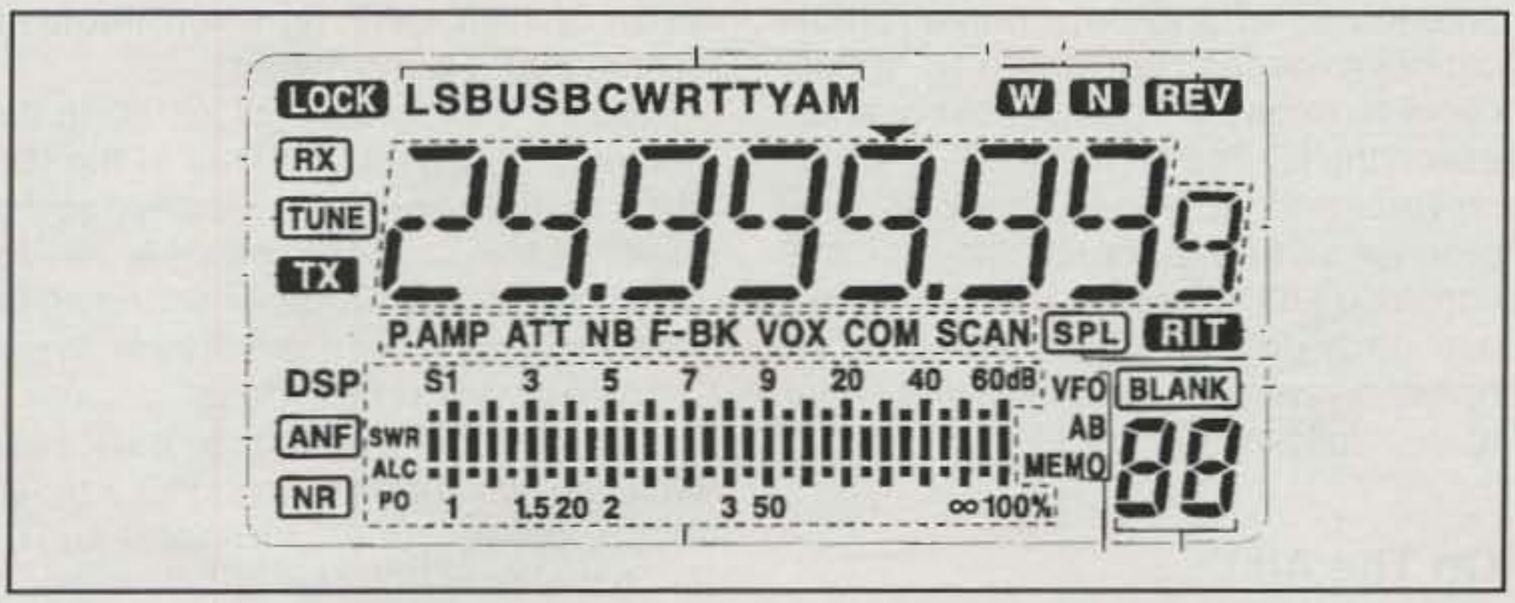

Fig. 2– A "show all" analysis of the IC-718's front-screen display. The screen shows selected frequencies, memories, and all operating parameters, plus a multi-function bar-graph-type meter.

easy to understand and use. On-screen guidance is just more convenient and time-effective.

Special Features

Due to its small size and low cost, many folks tend to visualize the IC-718 as a rather "plain Jane" transceiver. Look closer, however, and you will discover it sports some rather elaborate features and options for a rig of its price range. The IC-718's noise blanker, for example, is fully adjustable to fit varying band conditions rather than just being preset. An FSK generator complete with selectable tones of 2125, 1615, and 1275 Hz plus shifts of 850, 425, and 170 Hz is also included for RTTY/data mode operations. External linear amplifier T/R switching has also been streamlined to an RCA phono socket with the IC-718's relay directly switching up to 16 volts DC at 2 amps. An external switchbox or interface thus is not needed for connection to most linear amplifiers.

A choice of five optional 455 kHz IF filters lets you tailor the IC-718 to your operating preferences. If CW or RTTY is your main interest, for example, you can add a 500 Hz/FL52A or a 250 Hz/ FL53A in the rig's optional crystal slot. A 250 Hz filter usually requires an extra-steady hand for tuning in signals and also has slightly more insertion loss, so most folks choose a 500 Hz filter. If SSB is your favored mode, you can add a wide 2.8 kHz/FL96, a very narrow 1.8 kHz/FL222, or an ultra-wide and great-sounding 3.3 kHz/FL257 in the IC-718's single optional filter slot. The factory-installed/standard FL65 filter, incidentally, is 2.4 kHz

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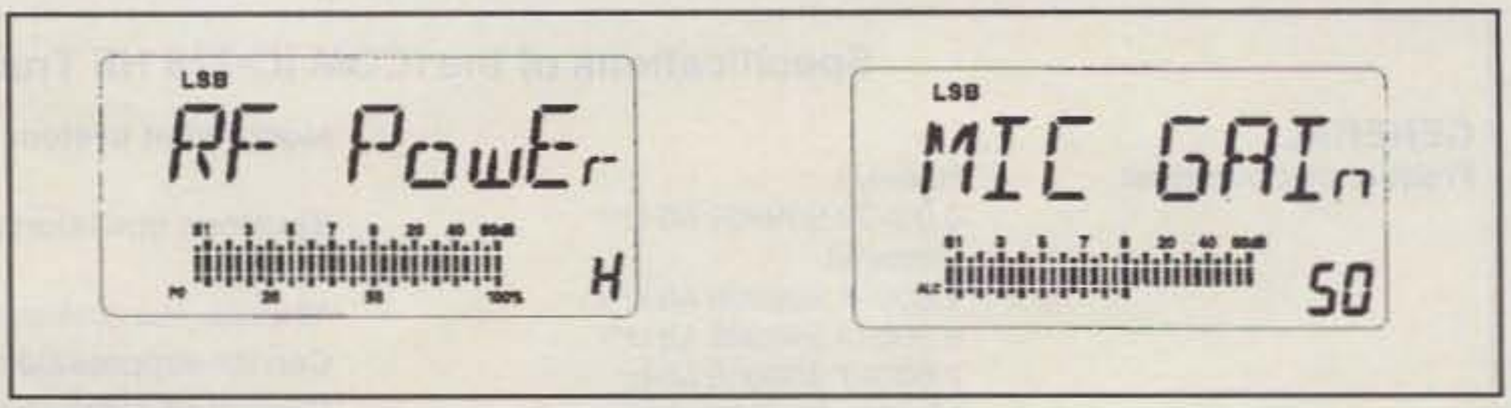

Fig. 3– Here you see two examples of how the IC-718's display looks when a menu-selected function is "called up" for adjustment.

wide. An optional filter must be soldered in place when installed, but "getting to" solder points is fairly easy. It just takes time and patience.

An optional UT-106 DSP module with automatic noise reduction and an automatic notch filter is also available for the IC-718. The noise-reduction section is really helpful for pulling weak signals out of the mud, but the "auto notcher" is a special gem. Whenever a tune-up heterodyne comes on frequency, you just push the "ANF" button and poof: It's gone. What a delight!

Some additional options and/or accessories for the IC-718 (and other model ICOM transceivers) also warrant brief recognition at this point. First is ICOM's PS-85 13.8 volt DC/20 amp power supply. This unit is exceptionally small, lightweight, and mates perfectly with the IC-718 to produce a complete "two box station" that fits almost anywhere. Next is ICOM's new IC-PW1, a fully solid-state 1000 watt output linear amplifier complete with automatic antenna tuner and detachable remote control/metering unit (photo B). It connects to antenna and accessory sockets on the IC-718 (or other ICOM transceivers with accessory sockets) and produces a fully automatic/no-tune station. You just select a band, and mode, dial up a desired power level on the transceiver, and the amplifier (plus tuner) "follows that lead."

On The Air

The real fun and games began when I connected the IC-718 to my new Hy-Gain AV640 vertical and hit the airwaves. Right off the bat I worked PY5BE in Rio, VQ9VK on Chagos in the Indian Ocean, and UAØAZ near Siberia. I could not stop the rig from working DX! It even reminded me of that old-time song about the chap in a little Nash Cosmopolitan (comparable to a Geo Metro today) outrunning a big Cadillac. After rat racing a few miles, the Nash driver dropped back fender to fender with the Caddy driver and yelled out "Hey, buddy, how do you get this car out of second gear?"

Seriously, however, the IC-718 is a neat little economy transceiver with some good assets to its credit. It has good talk power for SSB, runs cool and calm at full output on CW, and is also fun to use on 29.0 to 29.1 MHz AM activities (FM operation, however, is not included). The IF Shift is quite effective for minimizing adjacent frequency QRM (It works better than expected!), and receiver sensitivity (which can be varied with the panel-selectable preamp or attenuator) is superb. The AGC is sort of fast and not directly adjustable, but that "busy band" or almost pumping sound it makes can be minimized simply by reducing the RF gain control's level.

Thanks to its iambic keyer, full QSK and, switch-selection of normal or reverse sideband reception, working CW with the IC-718 is a real pleasure. It also makes a killer QRP rig when throttled back to 4 or 5 watts output.

Earlier I mentioned that installing an optional 3.3 kHz/FL257 filter in the IC-718 could change its *receive* audio response from rather narrow-banded to rich, full-bodied, and super-sounding (a hot trend among serious SSBers). In my December "World of Ideas" column I also suggested adding a new Heil "Goldline" microphone to the IC-718 for equally great sounding *transmit* audio. Since that time Bob Heil has developed a studio-grade condenser mic specifically for ICOMs with 8-pin mic sockets, and it sounds absolutely phenomenal. Add one of these new mics to an IC-718, and you will have an awesome SSB signal (Bob's telephone number is 618-257-3000).

Fig. 4– Block diagram of the IC-718. For a brief technical explanation/discussion see text. →

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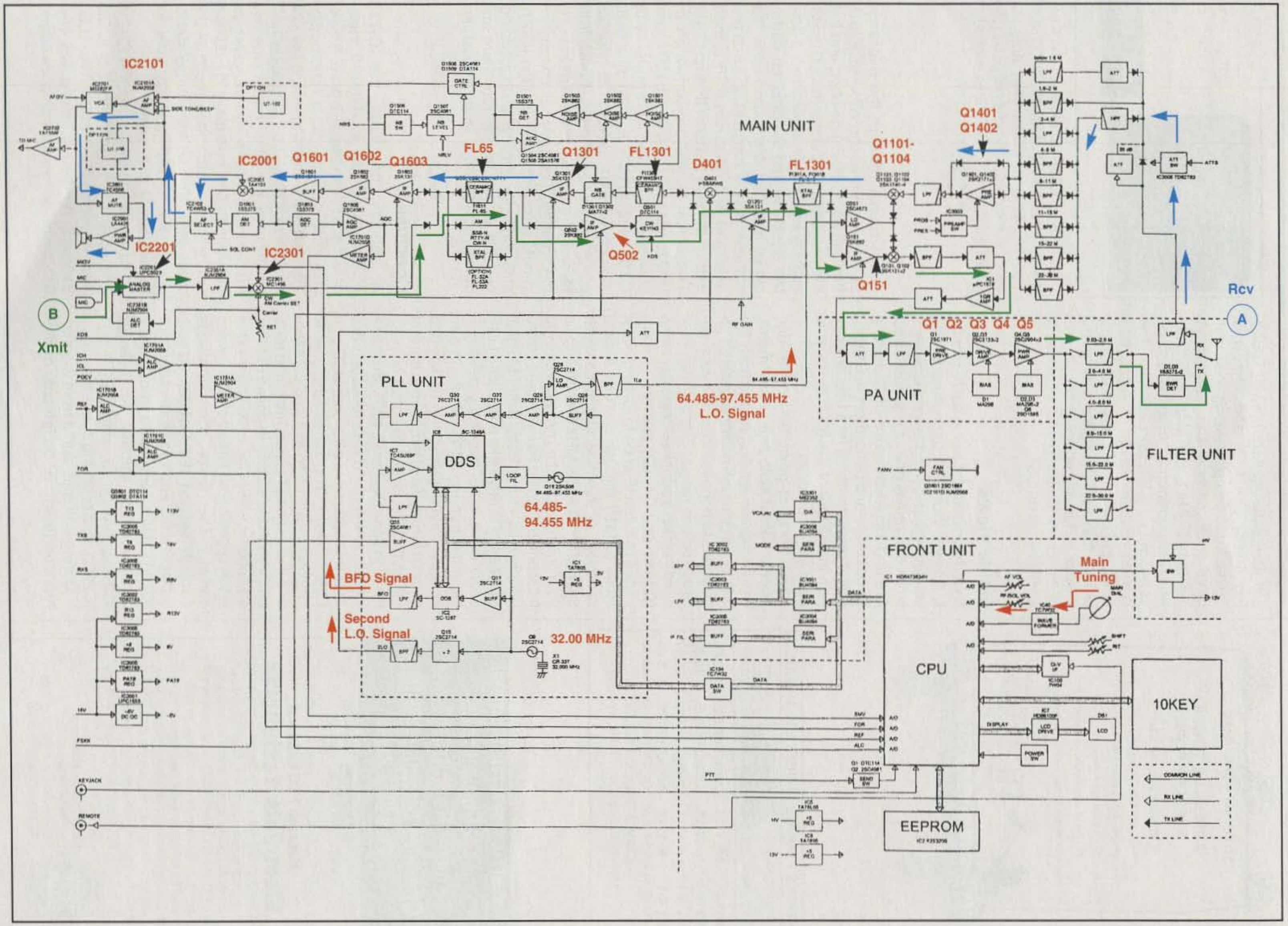

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If you really want blow-away sounding audio, one final and somewhat "exotic" mic-complementing idea warrants quick mention. Consider replacing the IC-718's 2.4 kHz/FL65 filter, which is common to *transmit and receive,* with a 3.3 kHz/FL257 filter. This is a technical endeavor. It may not be a quick and easy swap, and if improperly done it may void the rig's warranty, but it (plus a Heil microphone) should produce totally exquisite audio seldom (if ever!) heard on SSB.

Inside Views

If you have been following our bi-monthly "How It Works" column here in *CQ,* you know that looking at a transceiver's block diagram is one of the most effective and impartial means of visualizing its operation and performance. Bearing that thought in mind, let's take a whiplash inside tour of the IC-718. Refer to fig. 4 as we proceed.

Beginning at point "A" on the diagram's right middle side, incoming/received signals are first routed from the T/R switch through one of several CPU-selected bandpass filters for your desired receive range. Signals then proceed through a panel-selectable preamp (Q1401 and Q1402) and are up-converted to a first IF of 64 MHz by the first mixer (Q1101 through Q1104). A local oscillator or injection signal between 64.485 and 94.455 MHz (depending on your desired operating range) is derived from one of the two PLL (Phase Locked Loop) units in the DDS (Direct Digital Synthesis) to drive this mixer. The DDS acquires its exact frequency-determining data from the CPU, which in turn accepts input data from the 10- key pad or main tuning dial. Returning to the first mixer, 64 MHz output signals then pass through ceramic filter FL1301 which limits its bandwidth to 15 kHz (because this filter must pass AM plus both USB and LSB signals). The received signal is amplified, converted to a 455 kHz second IF by second mixer D401, and routed through the factory-installed FL65 or an optional SSB, CW, or AM filter. (This is the spot where I hinted at filter swaps earlier.) The signal then proceeds through second IFs Q1603, Q1602, buffer Q1601, and into product detector IC2001. Resultant audio from Q1602 then proceeds through AF selector IC2102, through AF amp IC2101 and IC2901, and on to the speaker.

During transmit, audio from the microphone (point "B" on left side of diagram) routes through the mic amp/speech compressor/VOX (IC2201), through an audio-range filter, and into the balanced modulator (IC2301). Assuming SSB mode is selected, a double sideband and suppressed carrier signal is output and routed back "the opposite way" through FL65 (drop one sideband to produce an SSB signal), and on through transmit IF amp Q502. The signal is then up-converted by D401, passed through FL1301, and converted to the transmit frequency by Q101 and Q102. It then proceeds through IC1, 01, drivers Qs and Q3, power amps Q4 and Q5, transmit filters, and on through the T/R relay to the antenna. The previous description should familiarize you with the IC-718 sufficiently for general understanding, so I will let you take it from there and delve into additional study as you like.

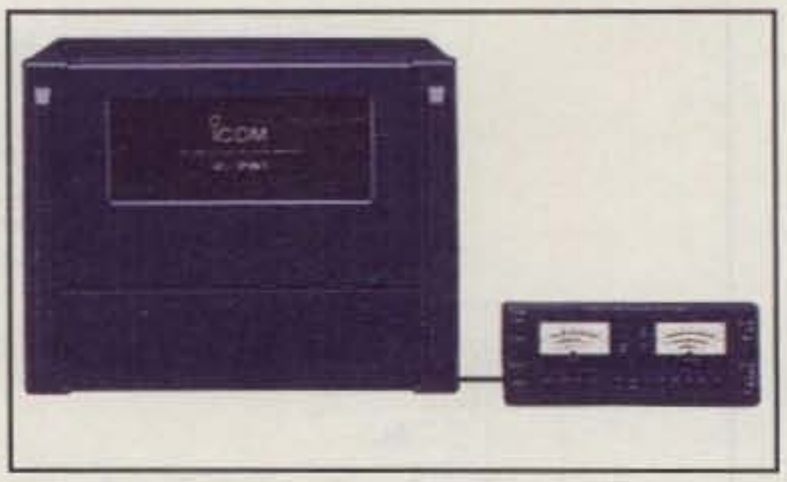

Photo B– ICOM's optional IC-PW1 all-solid-state, fully automatic 1000 watt output linear amplifier and antenna tuner is the perfect finishing touch to the IC-718 (or other ICOM transceivers). It is truly first class!

Conclusion

All aspects considered, the IC-718 strikes me as a very good little HF transceiver at a fair and square price. It is not an IC-756 Pro, but I will bet a sharp operator can work anything with it he/ she could work with a '756 Pro. I cannot necessarily say the same for transceivers from 20 or 30 years ago, however, as new generation rigs really do receive and transmit better than much of the older gear. Viewed from those standpoints, the IC-718 gets my vote for "affordable rig of the day."

For more information on the IC-718 and other ICOM gear, contact ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 (phone 425-454-8155; web: <www.icomamerica.com>.

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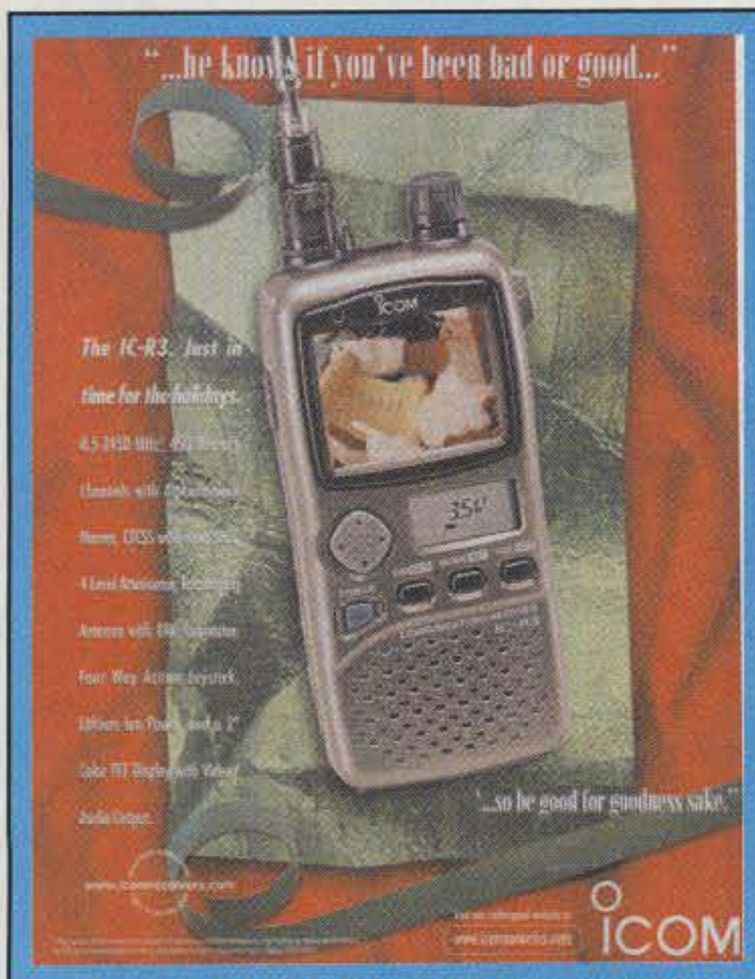

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Fuel cells are at the cutting edge of energy technology. W3IA tells us how they work—and how well they worked as an alternative power source for his Field Day station.

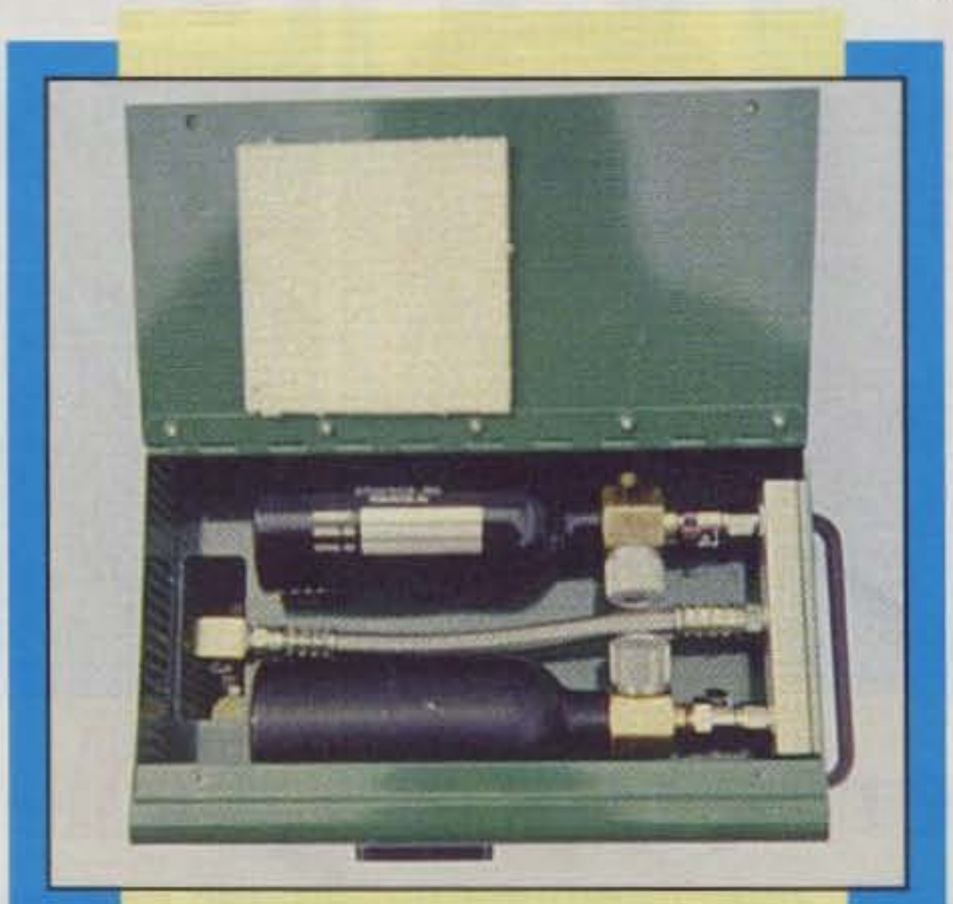
Fuel-Cell-Powered Amateur Radio

BY TOM CHESWORTH,* W3IA

Within the past few years a lot has been written about and a lot of research and development has been done on fuel cells, environmentally-friendly power sources whose only waste product is water. The opportunity to use a fuel cell to power an amateur radio station presented itself last spring at the Power Sources Symposium in Cherry Hill, New Jersey, where H Power out of Belleville, NJ, was one of the commercial exhibitors. Among the company's other fuel cells, they were demonstrating a small, portable, and completely self-contained fuel-cell-driven power unit. A bit of charm and a bit of persuasion, and the folks at H Power kindly made available one of their pilot-line production units, serial number 23, for use during Field Day 2000.

Fuel cells recently have been much in the news because they are being used in buses and are being considered for use by several large car companies (Toyota, Ford, and Daimler-Chrysler among them) for private family electric vehicles. The fuel cell is not new, however. In fact, it was invented in 1839 by Sir William Grove.

For the most part, since then fuel cells have been either laboratory curiosities or special devices with limited uses. NASA used alkaline fuel cells in the Apollo spacecraft to provide electricity using rocket fuel and oxygen which were aboard in relatively large quantities for other purposes. The waste product, water, was useful in a spaceship. From time to time fuel cells were used to power farm tractors or other electric vehicles to prove that it could be done, but by and large the machines were extremely expensive, not very efficient, and not well received. For many years the military has used fuel cells in special niches where their virtues outweighed their problems. In submarines, for example, the waste product, water, was not so difficult to deal with as the fumes from engines. The recent surge in interest has been generated primarily by the insistence of the state of California on environmentally-friendly vehicles and the discovery of an effective polymeric electrolyte, the Proton Exchange Membrane (PEM), which we'll discuss more later.



The fuel-cell power unit has only one control—an on-off switch. The unit also has a power meter, a panel light, an output jack, and two fans, one each on the front and the back.

Technically, the fuel cell is a kind of battery. As with other forms of battery, there are several fuel-cell chemical reactions that can be recharged by replacing the products with fresh reactants. The hydrogen-oxygen reaction is only one of them, but it may turn out to be the most important. In any case, it is the one used in the H Power unit and most of the new fuel-cell- powered electric vehicles. Therefore, this discussion will concentrate on the hydrogen-air (oxygen) reaction.

How Fuel Cells Work

You may remember the experiment in high school chemistry where hydrogen and oxygen were produced from water using a DC electric current. Well, the reaction is reversible. *Under the right conditions,* hydrogen and oxygen can be combined, not burned, to produce water and DC electric current, based on the following formula:

$$2H_2+O_2 \rightarrow 2H_2O$$

Caution: Under the wrong, ordinary conditions a mixture of hydrogen and oxygen *explodes* according to the above equation *(so don't try this at home!—ed).*

The primary problem with fuel cells is in arranging the conditions so that the chemical reaction will proceed spontaneously and drive an electrical current through an external circuit. If the reactants are mixed and the reaction triggered (for example, with a flame) the entire reaction occurs locally. That is, two atoms of hydrogen, which are neutral, and one oxygen atom, also neutral, are ionized by the flame. An oxygen atom with two extra electrons is in a lower energy state than a neutral oxygen atom, so two extra electrons fall into the oxygen atom. The two resultant positively charged hydrogen ions are captured by the doubly charged oxygen ion and a neutral molecule of water is formed. Because of the electronic structures of the hydrogen atoms and the oxygen atom which caused this strange charge separation and physical joining in the

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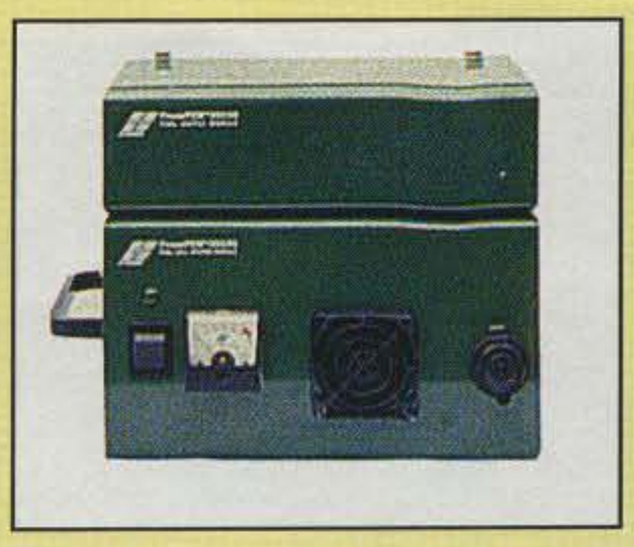
first place, the hydrogen ions (protons) are both attached to the same side of the oxygen ion. One side of the resultant water molecule is positive; the other side is negative. The molecule is neutral but polarized. All the motions of ions and electrons occur within a volume which is a few molecular diameters on a side. There is no motion of charge outside this volume.

To produce an external electric current, the reactants must be held apart by a separator. On one side of the separator is the hydrogen and a conductive structure (the cathode); on the other side is the oxygen (air; the nitrogen remains neutral) and a conductive structure (the anode). The two electrons from the two hydrogen atoms must now pass through an external circuit connecting the cathode to the anode to form an oxygen ion. The two resultant protons must pass through the separator (the polymeric electrolyte) to produce a water molecule. It takes energy to cause the electrons to traverse the external circuit and more energy to pull the two protons through the separator. The difference in energy between two hydrogen molecules (each is formed of two atoms) and one oxygen molecule (also composed of two atoms) on the one hand and two molecules of water on the other is way more than enough to cause the reaction to proceed if there are no losses. However, there are losses primarily in the process of crossing the separator and in the load in the external circuit.

A major step forward in fuel-cell technology came a few years ago with the invention of the PEM (Proton Exchange Membrane), a thin membrane very permeable to protons. It dramatically reduced the energy lost when the protons cross the separator and allowed the reaction to proceed at normal temperatures and pressures. It is now used in most modern fuel cells. This breakthrough is one of the primary reasons why hydrogen-air fuel cells are now being used in buses and prototype electric vehicles of all kinds, and perhaps more important for hams, in pilot commercial power-generation stations and prototype units for providing electric power in homes. The waste product is environmentally-friendly warm water. Hydrogen can be produced from water using hydroelectric, geothermal, or atomically-generated electricity, or it can be produced from chemical compounds such as butane, ammonia, or methanol.

A few nagging problems remain. In the first place, even with a PEM, the losses must be further reduced by enhancing the chemical activity of the process with a catalyst. Platinum is the current catalyst of choice.The fabrication of PEMs and the physical construction of fuel-cell stacks using them are brand new technologies. In addition, fuel flow, air flow, stack temperatures, and output voltages all must be properly controlled—all new technologies in this context. The result: Fuel cells are expensive. Second, hydrogen storage and delivery is a problem.

Hydrogen can be bought bottled from most industrial gas suppliers. The problem is that as a gas it must either be under very high pressure—say, 20 atmospheres—or come in very large containers. It can be stored and delivered *adsorbed* to a metal hydride alloy (*adsorption* is the collection of molecules of one substance in condensed form on the surface of another substance) or as a liquid which requires very low temperatures and high pressure, or in a chemical compound.



The fuel compartment at the top of the fuel-cell power supply has fittings for two bottles of hydrogen. Two full bottles will deliver 50 watts for four hours.

The hydrogen fuel for the fuel cell is contained in Coke-bottle-size refillable steel bottles. Each contains enough hydrogen to fill a good-size weather balloon.

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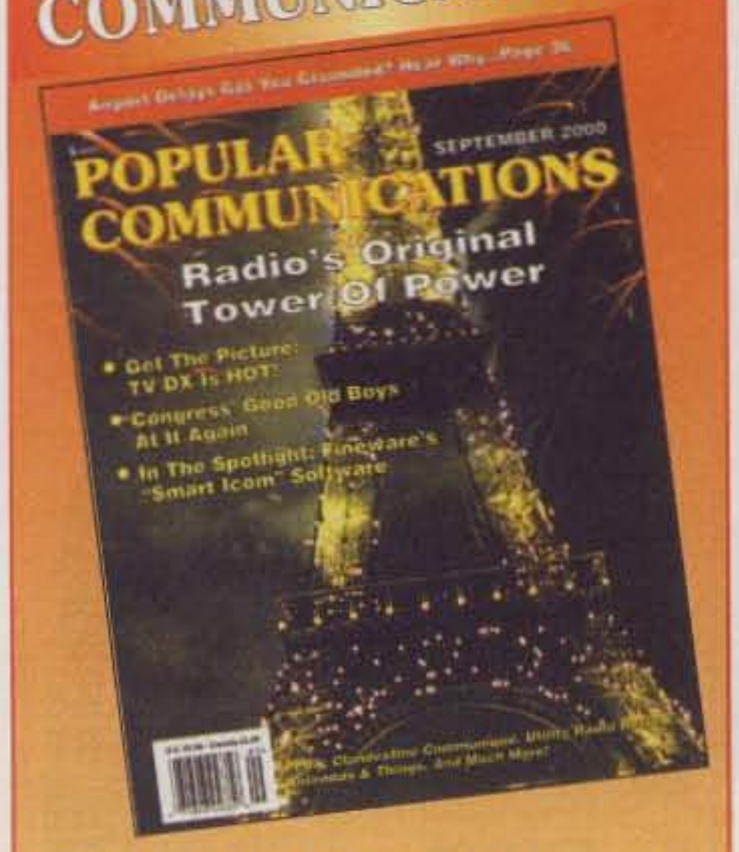

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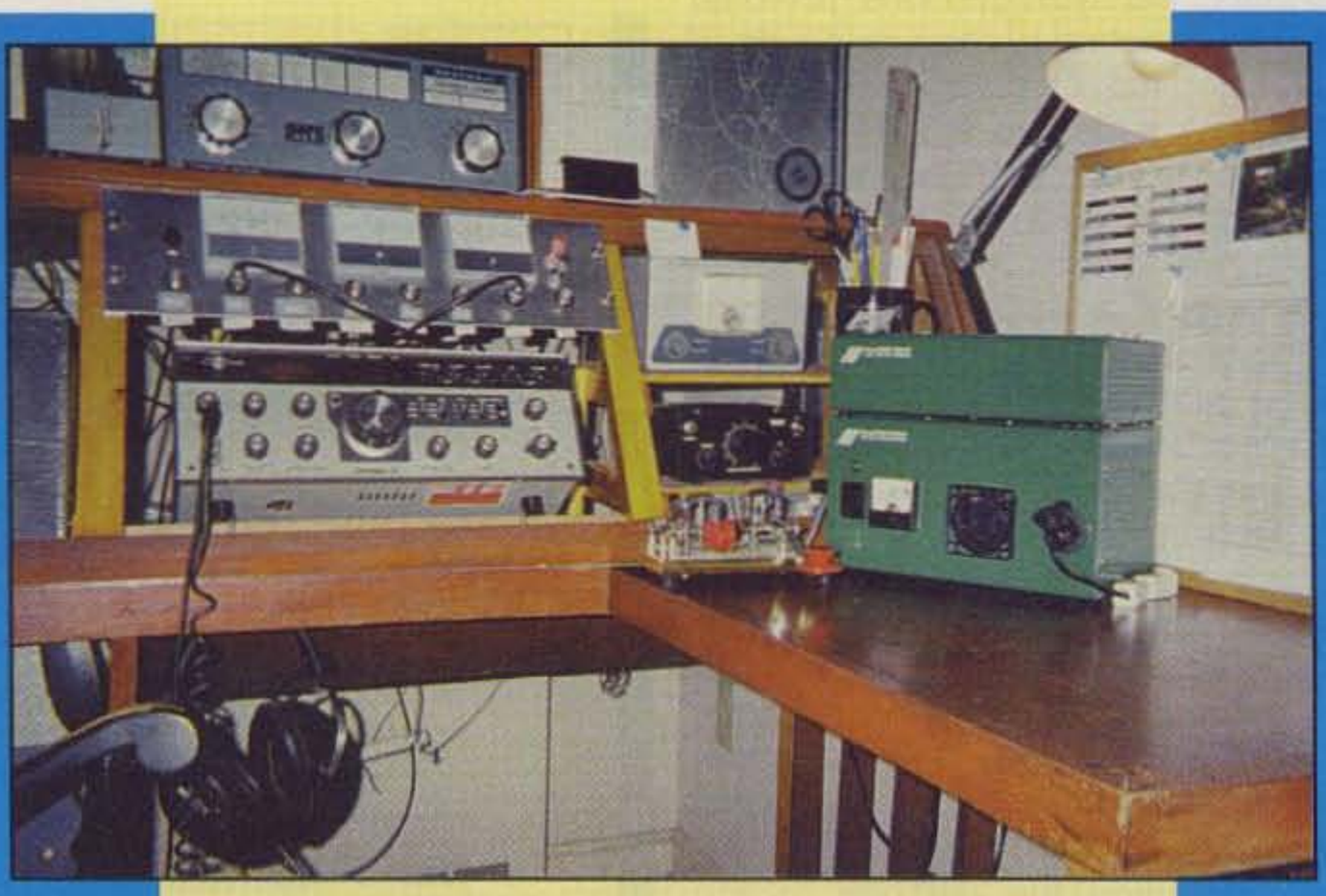

The Field Day operating position at W3IA. To the right of the gear from the previous millennium is the H Power fuel-cell power supply.

The ratio of the amount of hydrogen that can be stored as a liquid or solid chemical compound compared to the amount that can be stored as a gas at atmospheric pressure in the same volume is approximately the ratio of Avogadro's number to Loschmidt's number —about 10,000 to one.[1] The best solution is to get the hydrogen from natural gas, butane, or a liquid such as methanol. However, the hydrogen must be chemically stripped from these compounds, usually requiring a reformer. Present reformers are large, inefficient, and expensive.

All of the problems notwithstanding, there is great promise in fuel cells. They may indeed be the way that electricity will be generated in the 21st century. In the recent past in the U.S., the main market for fuel cells has been NASA, the Department of Defense (DoD), and other government agencies. Recently, more companies have been formed and more markets have opened, mainly for building-size fuel cells for commercial power plants and for smaller units to supply motive power for buses and other commercial electric vehicles.

H Power has been supplying fuel cells to DoD for eleven years. Recently they developed a unit to power lighted variable message signs for use along highways. The fuel-cell niche markets are small and development costs are high, so when H Power realized that the fuel- cell unit designed for the signs could be sold as a portable power source, they repackaged it and are in the process of developing this market.

The H Power PowerPM®-SSG50 is the result of this repackaging. This entire fuel-cell power unit is just 48 cm wide, 28 cm high, and 37 cm deep (19 ×11×14.5 inches) and weighs only 13.5 kilograms (about 30 pounds). The output is regulated at 12 volts to match automobile batteries, and the unit has a "cigarette lighter" output connector. Actually, the unit's regulator was set to 15 volts and was not readjusted. It will deliver 50 watts of continuous power. Into a constant load the fuel-cell power unit is 45% efficient (energy delivered to the electrical load as a percentage of energy available from the hydrogen-oxygen reaction).

The system consists of two separate but attached boxes. In the top box are the fittings and holders for two bottles containing metal hydride alloy filled with hydrogen. In the bottom box are the fuel-cell stack, the feedback control system with an automatic hydrogen pressure control valve, two 9 volt batteries, and a solid-state voltage regulator. Although the stack runs reasonably cool, only 50° C (122° F), there are two fans to ensure that air circulates inside the box and the stack does not overheat.

If desired, the top box of the unit can be removed, revealing fittings necessary for the unit to be fueled from a tank of industrial-grade hydrogen fitted with a pressure regulator, instead of from the small bottles. During Field Day I used the bottles. When the hydrogen is depleted, these small bottles are replaced.

The H Power PM-SSG50 fuel cell sat just behind the key on the operating desk and performed flawlessly throughout Field Day 2000.

The empty bottles can then be refilled from large tanks of industrial-grade hydrogen.

The hydrogen equilibrium pressure over the metal hydride alloy inside the bottle is 250 psi, and a full bottle contains 70 liters (74 quarts) of H_2. A full bottle of hydrogen will power a 50 watt load for two hours. Four full bottles were supplied with the unit. The transceiver drew 1 amp on receive, and the RF level control was set so that it drew 50 watts out of the power supply key down. Half the time is spent listening, and spaces take up about half of the transmitting time, so the average power was about 12 watts. The four bottles should have lasted for about 30 hours of on-the-air contest time. In fact, the unit was returned with hydrogen still left in the last of the bottles. Each bottle is 18 cm (7 in.) long including fittings, 5 cm (2 in.) in diameter, and weighs 4.5 kg (about 10 lbs.), mostly the weight of the metal hydride alloy and the steel bottle.

The bottom box contained the fuel cell stack itself. The area of each cell is about 8 × 11 cm (3 × 4 1/3 in.), and the stack, including bottom and top plates, is 6 cm (2 1/3 in.) thick. The details of the construction of the stacks is proprietary information, but it's possible to gain some insight into the problems that had been solved by describing the cells

Each cell consists of a piece of cellophane-like material, the DuPont PEM, sandwiched between two pieces of metal, insulated from each other, that allow gasses to pass through holes in them to the PEM. Structurally, this thin sandwich has to hold together with free-flowing air at atmospheric pressure on

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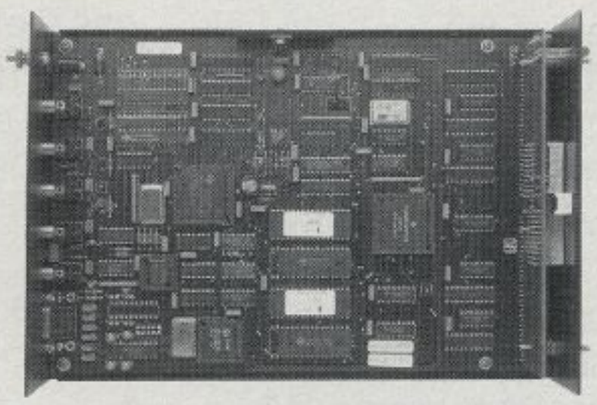

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one side and hydrogen at 6 psi on the other. The stack is comprised of 25 of these 0.7 volt cells.

As with the explosion of hydrogen in air, the reaction in the fuel cell has to be triggered. The power unit contains two 9 volt batteries to kick-start the cell stack and to power the electronic control circuits while the unit wakes up. Once operating, each cell is kept operating at its Stoichiometric point (the point at which the elements combine most efficiently; analogous to resonant frequency in radio) by a solid-state feedback control system which senses current and adjusts the fuel flow. The control system also senses stack temperature and controls the fans, which not only enhance cooling, but also remove water vapor and replenish the oxygen, fresh air, inside the stack. There is a meter for monitoring stack performance on the front of the box which reads output power, in watts, on a linear scale.

Fuel Cells on Field Day

During the whole of Field Day, the fuel-cell power source operated flawlessly, although there were some idiosyncrasies that took some getting used to. First, the power-supply–transceiver system needed to be fine tuned. The receiver worked perfectly from the get-go, but the transmitter needed tweaking. The transceiver was initially "tuned for maximum smoke," in time-honored ham tradition. Well, as most of us have discovered, that usually doesn't work, but it's always worth a try. You never know. The power source might have delivered peak currents well above steady state levels. No such luck. Either the voltage regulator was also a current limiter or the IR losses in the cells at high currents dropped the potential, causing the regulator to dump the load, or both.

The power meter on the fuel-cell unit pegged at 60 watts; above 50 watts it was in the red. When the rig used more than 60 watts, the regulator immediately kicked out. Between 50 and 60 watts on the meter, the CW tone was rocky and the power input to the transceiver was none too steady, according to the meters in the power supply leads. When the transceiver ALC was backed down so that the power meter on the fuel- cell unit read 50 watts or less key-down, everything was perfect. The receiver circuitry still drew its 1 amp even during transmission; the transmitter drivers were drawing some power and the final was about 50% efficient. This meant that the transceiver was delivering about 15 watts of RF to the antenna. That won't get too many phone contacts on crowded Field Day bands, so for me, it would be CW "de W3IA 1E WPA."[2]

The fuel-cell power unit was operated on the desk in the shack right beside the key. The unit never even got warm to the touch, there was no noticeable rise in humidity, and, of course, no noxious fumes. There was, however, noise. This was a surprise, since fuel cells are dead quiet.

First there was the unexpected thump every time the solenoid opened the valve to the hydrogen bottle. The hydrogen in the cell and associated piping had been depleted, so the pressure was down. When the valve opened, hydrogen at 250 psi rushed into the plumbing within the unit with the same effect as an air hammer in the plumbing of a compressed air system—Bang!

Then when a call was too long, or was short but sent at 5 WPM, the increase in average power caused the stack temperature to rise above allowed levels, and the thermistor caused the electronics to turn on the tubeaxial fans, which whispered.

The first hydrogen bottle unexpectedly gave out around midnight. The fuel cells called on the bottle for more hydrogen . There was not enough, so the voltage dropped and the regulator dropped the load. However, there was still enough fuel to again light off the fuel cell, so the load was reconnected, the fuel cells called for more hydrogen, et cetera, et cetera. It sounded a lot like feedback causing a VOX to kick in and out or, if you're old enough to remember, a vacuum-tube RF oscillator squedging in the audio range. Was it the death throes of a borrowed, several thousand dollar, piece of equipment? Ah, what is Field Day without a few moments of abject panic? A little cool-headed reflection and a new, full hydrogen bottle and all was well.

Environmentally-friendly emergency power all the way. Another successful Field Day is entered in the log.

Notes

1. For the non-chemists among us, Avogadro's number is the number of molecules in one gram molecular weight of a pure chemical compound; Loschmidt's number is the number of molecules of a perfect gas in one cubic centimeter at zero degrees centigrade and atmospheric pressure.

2. W3IA finished Field Day with 150 contacts and 600 points, 48th place overall in the 1E category and first in 1E in the Western Pennsylvania section. Source: *QST*, December 2000. ■

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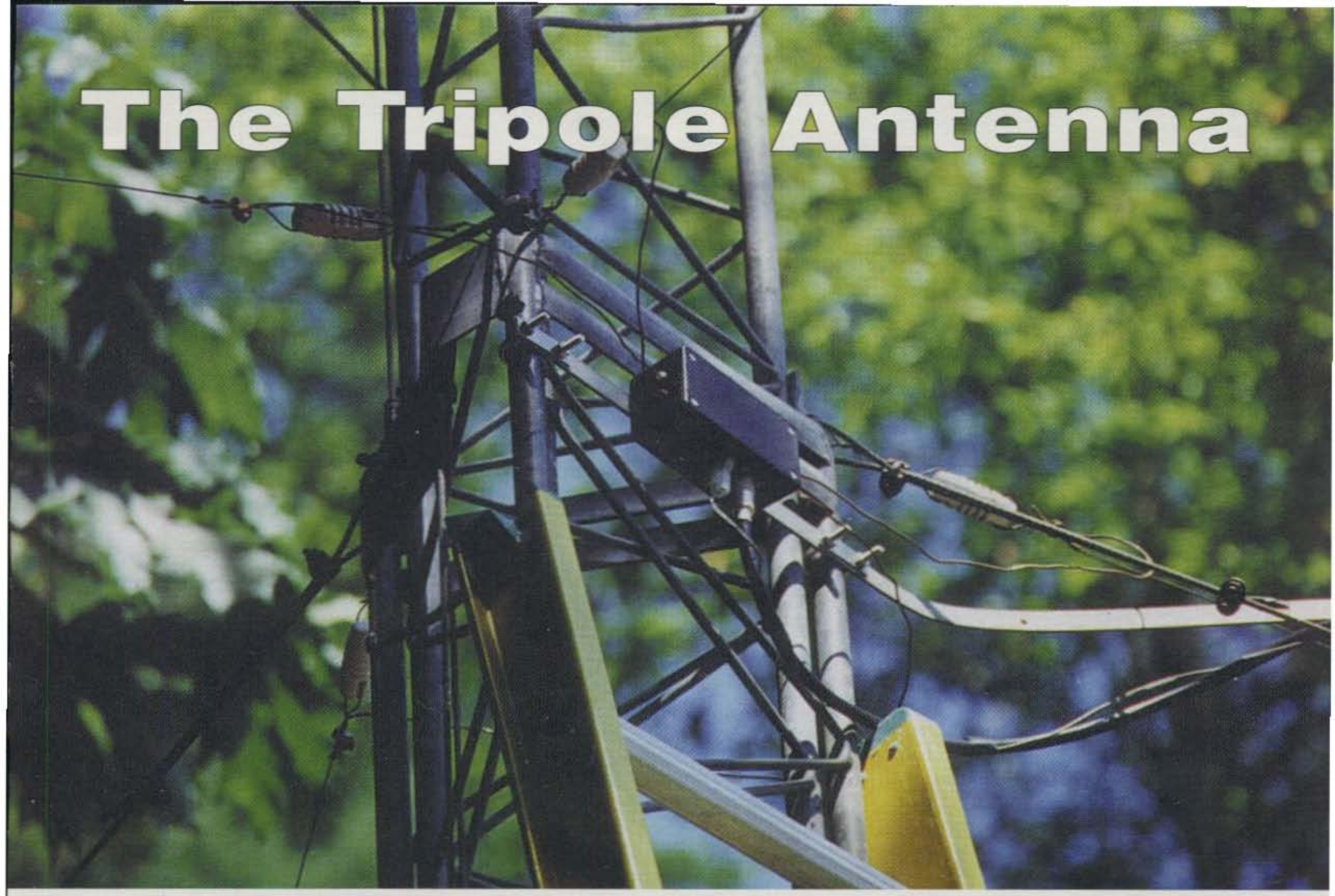
The Tripole Antenna



Close-up view of the 20 foot point on the author's tower where his four driven radials come together to form the tripole antenna. (Photo by Dick Miles, K7RNZ)

When is a vertical not a vertical? When it's also a pair of horizontal dipoles. Confused? Read on...

BY PHIL FERRELL,* K7PF

On a recent visit to my house, Dick Bingham, W7WKR, tossed a thumb at my tower. "Why don't you put a few radials on that and drive the radials?" he asked. I was getting ready to put up a 75 meter vertical, and his suggestion fell on attentive ears.

My tower is a 30-year-old Tri-Ex MW65 (four-section, tilt-over–crankup) which fully extends to 65 feet. The tower-top rotator holds a 10 foot section of 2.25 inch thick-wall T4 aluminum pipe. Various HF and VHF antennas have been up there over the years, but it currently hosts a pair of 13-element VHF Yagis. Attached at the top of the pipe is a Diamond X-510 dual-band vertical collinear, which is 17 feet long. The tip of that is 92 feet above ground. The tower is guyed at the 20 foot level, and one of the guy cables acts as a messenger, carrying all transmission lines and rotator control wires to the house. Neglecting the top loading due to the VHF Yagis, that leaves 72 feet above the elevated ground plane at 20 feet, a little more than a quarter wave on 80 meters.

With help from Jack West, W7LD, and Mike Michaeledes, W7ADR, four insulated 62 foot radials were placed at 90° intervals and attached to the tower at the 20 -foot level. The four radials were connected together using a ring made of #12 copper wire attached to each radial with a copper split-nut. The center conductor of the 50 ohm coaxial feedline was connected to the radial ring, and the coax shield was grounded to the tower. Details are shown in fig. 1.

At this point, I had an excellent vertical antenna with a VSWR of less than 2:1 over an incredible 400 kHz bandwidth (3.7 to 4.1 MHz). With the elevated ground radials in place, the resulting vertical antenna showed 32–34 ohms resistance and 0–20 ohms reactance over the 75 meter band. Keep in mind, though, that the radials were the driven elements of this "vertical"; that turned out to be a very important distinction.

I became very curious as to why I'd never heard of this crafty road to a nifty vertical. I queried vertical antenna expert Rudy Severns, N6LF[1], via e-mail,

**e-mail: <philf@olypen.com>*

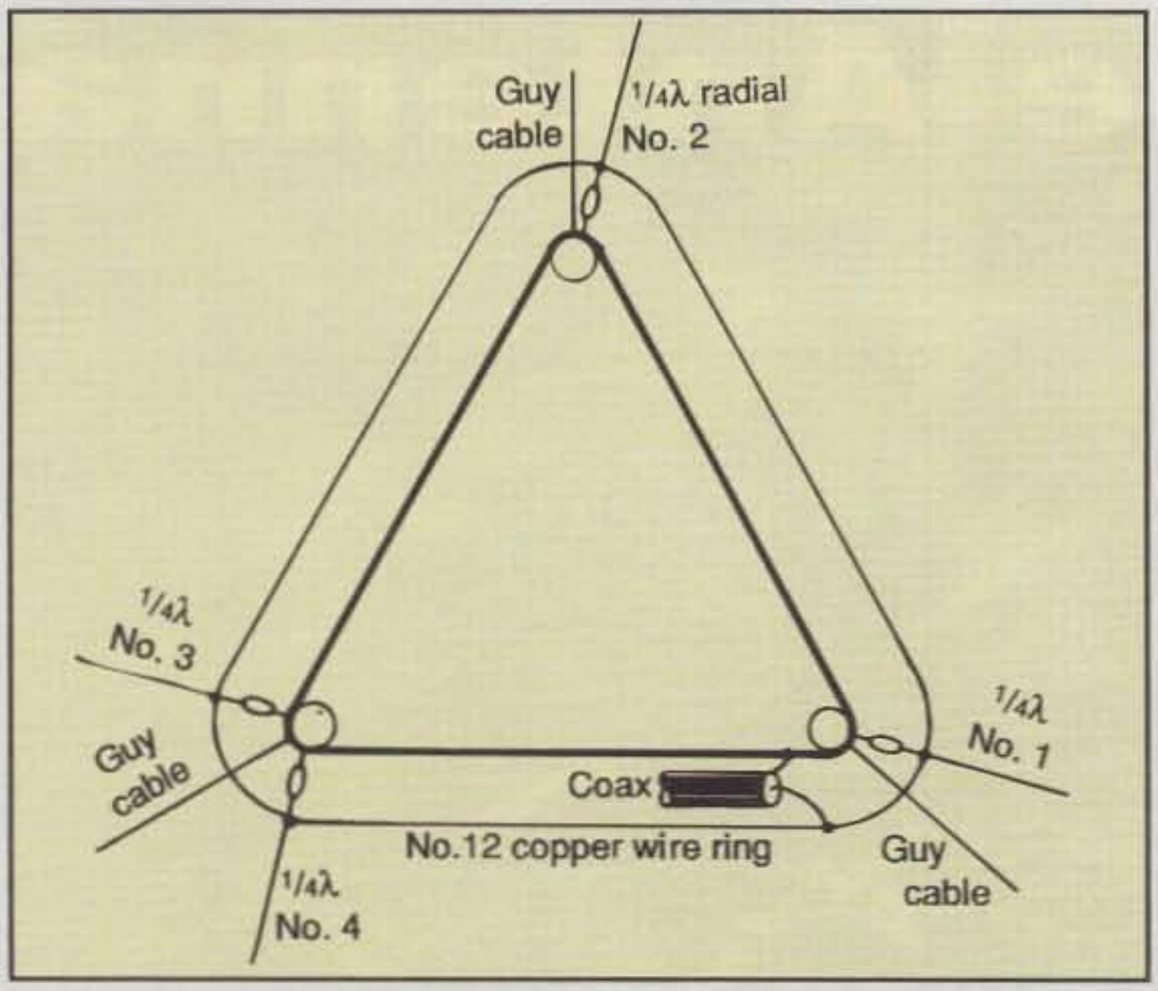


Fig. 1– Arrangement and connection of the four quarter-wave radials to create the elevated ground-plane vertical. Note that the center conductor of the coax goes to the copper ring connecting the radials, and that the shield is grounded to the tower.

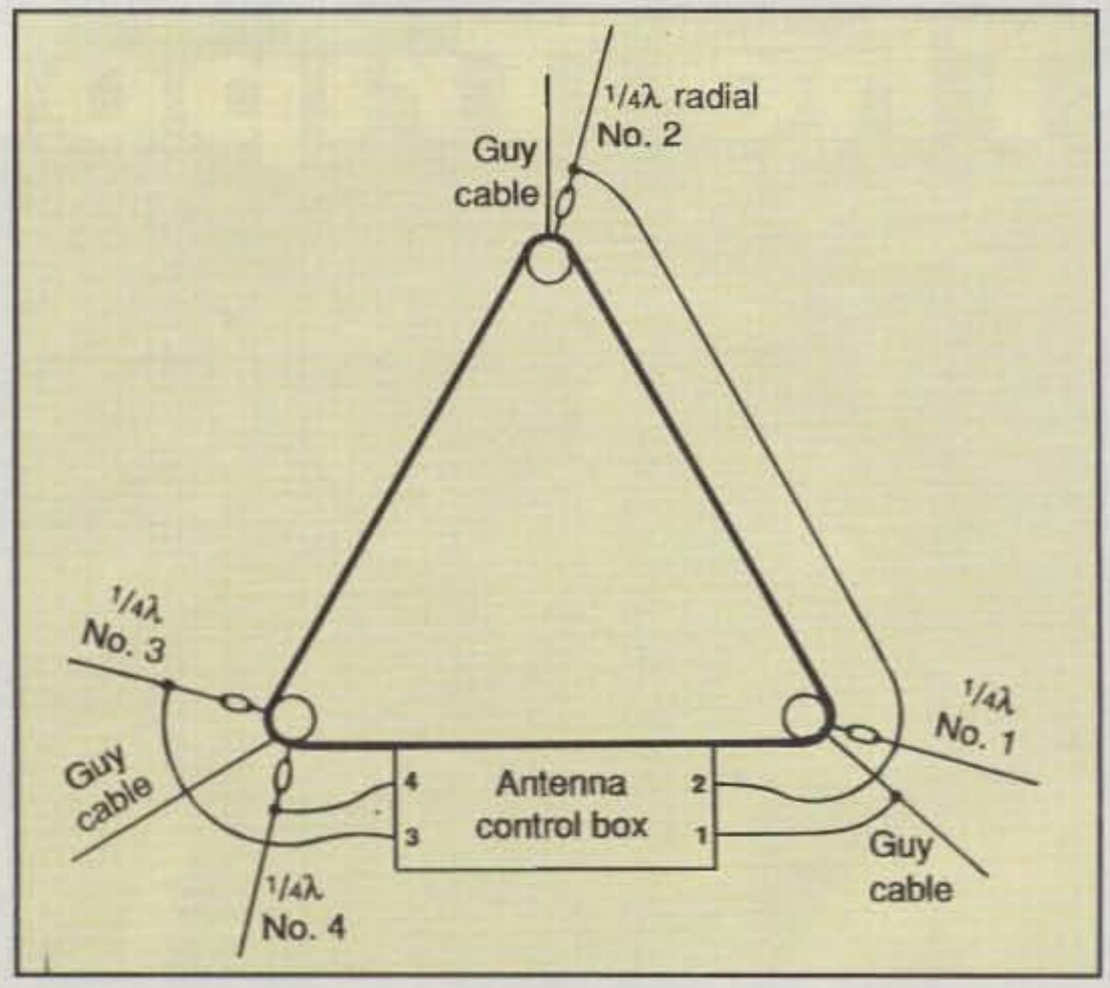


Fig. 2– Same arrangement of radials, but with the copper ring replaced by a switchbox and separate feedlines to each radial. This permits operation of any two sets of near-parallel radials as a half-wave dipole.

and he assured me that mine was a well-known configuration. He included a reference to a *QST* article[2], which describes my antenna as an "elevated ground-plane" vertical.

Radials or Dipoles?

I gradually noticed that local signals were weaker on the vertical than on a short horizontal wire. The new vertical gave superior performance for long-range, presumably low-angle, signals and on local vertically-polarized signals. Next I noticed the similarity between the four quarter-wave elevated radials and a pair of low horizontal dipoles at right angles. Thus arose the idea for the *tripole antenna*.

It got so that when I looked at my tower, I saw two half-wave dipoles instead of four ground radials. There had to be a way to have it all. A little back-of-the-envelope doodling gave the answer.

It takes three DPDT relays to reach all three antenna configurations (two horizontal dipoles and the elevated ground-plane vertical). One relay changes from the vertical antenna to an internal balanced feed, and the other relays route the balanced feed to one of the opposed pair of radials, which becomes a horizontal half-wave dipole (see fig. 2). The unused pair of radials remain connected together at the center, but are at right angles to the energized dipole so that little RF current is induced on the unused dipole.

Fig. 3 shows the wiring of the DPDT relay contacts. It also shows a simple antenna selector switch and how to connect the relay coils to achieve antenna switching. I used 12 volt relays with 160 ohm coils and contacts rated at 15 amps. I also used a separate control line for the relays. At the cost of a couple of RF chokes and coupling capacitors, you could use the RF transmission line to carry the control voltage. If you do that, be careful not to have a "sneak circuit" short out the 12 volt source. That's really embarrassing.

I epoxied the three relays into a 2" × 2" × 5" plastic project box. An SO-239 female coax connector and a two-pin Molex provide RF and control connections. I used four box-mounted pin jacks as connectors to the radials. They just exactly fit the #12 copper wire leading to each radial, attached there with a split-nut. Each piece of #12 wire was burnished at each end and coated with Dow-Corning silicon grease (DC4). If female pin jacks are unavailable, female banana jacks can be substituted, requiring a male banana connector on each of the #12 radial connector wires. The control wire and coaxial feedline connectors were likewise weather-protected with DC4. All internal RF wiring uses short pieces of #18 nylon (Formvar®) coated copper wire.

Just a word about the 1:1 balun: The major consideration is that the toroid core fits inside the box. I used two foot-long pieces of #18 Formvar®-covered copper wire close-spaced to approximate a 50 ohm parallel line. This short piece of transmission line was bifilar wound around a 1 inch diameter toroidal core (from WA7OK's well-supplied junk box). Nine turns covered the inside of the core. You could use either RG58 or RG174 rather than the #18 copper wire for a 50 ohm line on the toroid. RG174 would limit the transmitter power, and with RG58 the resulting balun might not fit in the control box.

As you may gather, the balun is not very critical. Once upon a time, you could go to the local ham store and have a choice from a wide variety of ferrite cores. At least *I* remember when you could do that. RadioShack does not stock ferrite cores. Pity. However, they do stock the following parts for this project: Project enclosure (plastic and metal lids), RS part #270-1803; 12 VDC plug-in relay (DPDT, 15A contacts), #275-218; 1N4001 diodes, #276-1101; 0.22 µF 50 V capacitors, #272-1070; female banana jacks, #910-4240.

Tripole on the Air

The tripole works amazingly well. I use a DPDT center-off switch as a "rotator." The center off position gives me the "elevated radial" vertical, and each "on"

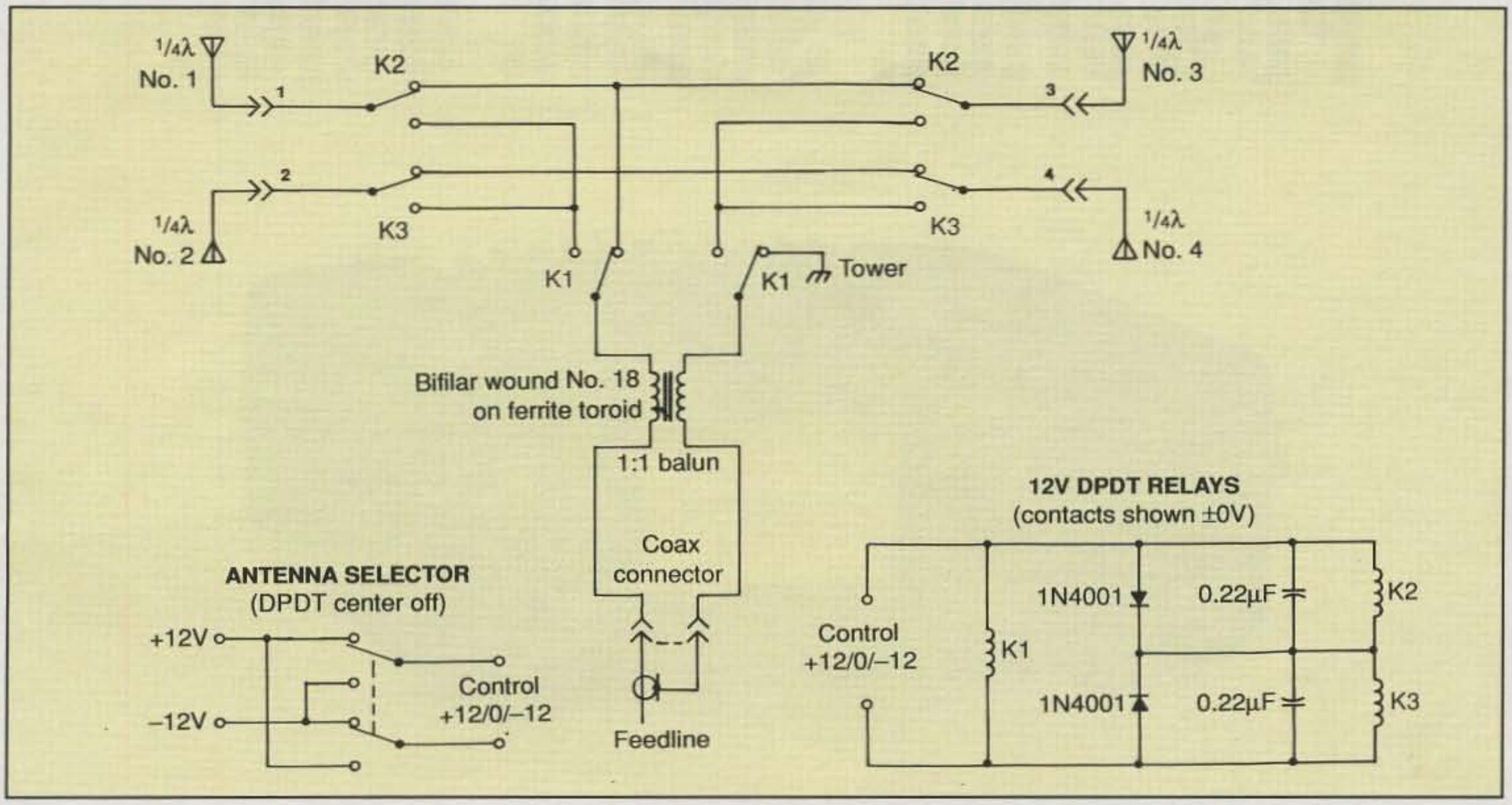


Fig. 3– Detail of the tower-mounted control-box circuitry. The 12 volt DC relay switches between either of two sets of radials and the elevated ground-plane vertical.

position of the switch activates one horizontal dipole.

Jack West, W7LD, lives about 13 airline miles from me. He has a large antenna collection, including a vertical dipole and a horizontal two half-waves in phase, both for 75 meters. Using either vertical-to-vertical or horizontal-to-horizontal polarization, we each are S9 to the other. Crossing our polarizations either way, we each drop to S5–S6. That squares with the real-world rule-of-thumb value of 20 dB cross polarization loss.

I regularly see a six S-unit difference between vertical and horizontal on some signals. That would have to include angle-of-arrival in addition to polarization differences. One of the horizontal dipoles seems to have a lower background noise level than does the other. Even if the S-meter shows a stronger signal on the "noisier" dipole, the "quieter" dipole can give a better signal-to-noise ratio (SNR). Received noise from the vertical seems to fall somewhere between that of the two horizontal dipoles.

A note on transmitting: You want to transmit on the antenna with the strongest received signal, but receive using the one with the best SNR. Thus you may find yourself doing a lot of antenna switching during a marginal contact. Switching between vertical and horizontal on transmit does measurably change the load seen by the transmitter, but no transmitter retuning is required in my case. Depending on tower height, top-hat capacity (guy wires or antennas), and available real estate for the radials, your tripole could be implemented on 160 or 40 meters instead of 75 meters. It adds an intriguing element to operating: What will happen when you switch antennas? Enjoy!

References

1. Severns, Rudy, N6LF "Verticals, Ground Systems and Some History," *QST*, July 2000, pp. 38–45.

2. Russell, Thomas, N4KG, "Simple, Effective, Elevated Ground-Plane Antennas," *QST*, June 1994, pp. 45–46.

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Very soon after the end of World War II, those hams lucky enough to be home were allowed back on the air. Not so for those still on active military duty...although, as K4IJS recounts, that didn't always stop them from trying!

A 20 Meter "Bootlegger" Fesses Up

How One Navy Ham Almost Got Back on the Air After WW II

BY TED SWALLICK,* K4IJS

The following is excerpted from Ted Swallick's memoirs, entitled "Remembrances–A Journey Going Backwards." Ted has submitted the full text to the Naval Minewarfare Association for possible publication. He is a retired engineering technical writer for the Air Force and NASA, and was first licensed as W2RKP in Bayonne, New Jersey. The experience Ted relates to us here occurred right after the end of World War II, with him serving as a Radioman 2nd Class on the U.S. Navy Minesweeper USS Speed, *in the waters off Japan and China. Recollections such as these are important parts of our history, and we are pleased to share them with you here.*

As we pick up Ted's story, the Speed *has just ridden out a typhoon off the coast of Okinawa, in October 1945.*

—W2VU

During the remainder of 1945 Admiral 'Bull" Halsey, Commander of the Fifth Fleet, put out the notice "NO HAM RADIO OPERATIONS ALLOWED USING MILITARY EQUIPMENT." However, over 5000 radio operators didn't hear the message and were calling "CQ, CQ, this is W5ABC..."

Speed continued minesweeping duties in support of the allied occupation of Japan. She proceeded to the waters of Formosa *(now Taiwan—ed.)*, providing various types of minesweeping with her sister ships. She docked at a facility in Formosa in November. Our radiowatch was secured and turned over to another ship for that night. I was in the radio room writing letters. I turned the power switch to the RBS radio to ON and turned the radio to the old ham radio frequency of 14,250 kcs. Blasting out over the loudspeaker came "CQ, CQ, CQ, this is W2AFN, W2AFN, calling CQ, CQ, CQ and standing by for a call...what say somebody...give me a call."

GEEZ! I powered up the LM-8 frequency meter, connected it or coupled its output to the RBS radio to measure its exact frequency. I then interfaced the frequency meter to the huge 6-foot-high, 3-foot-wide TBL-7 main shipboard radio transmitter. The next several steps were to give this monster transmitter some power. The generator power switch was set to oN, panel lights illuminated—remarkable—no one ever showed me or instructed me how to power-up this baby. I just tuned and adjusted each RF stage until the antenna RF amp meter indicated RF output at 15 amperes. The large pair of power amplifier tubes started glowing cherry red in the dark...a true amateur radio operation!

I quickly grabbed the microphone and called this guy... "W2AFN, W2AFN, W2AFN, this is... (Now this was a problem. I hadn't actually gotten my license before the war, so I had no callsign of my own. I thought very briefly before deciding to bootleg the callsign of my high school radio club in Bayonne, New Jersey.)... this is W2GYO, W2GYO, calling W2AFN. What say, old man, give me a shout."

The voice came back, "W2GYO, W2GYO, this is W2AFN, your signs are loud and clear. This is Air Force Major XXX in charge of the United States Armed Forces Radio Station here in Manila, in the Philippines. What is your location?"

Now came another "minor" problem. I hadn't realized that the ship's main transmitter could also be activated remotely until I heard yet another voice: "Whiskey, Whiskey, this is Sidecar, over." I realized it was coming from my own ship, and made a mad dash up to the CIC (Combat Information Center) room. Standing there in dim red light were the XO (Executive Officer) and the Communications Officer.

"Excuse me, sir. You are using the wrong handset microphone, sir."

"How do you know?"

"Well, you keyed the TBL-7 transmitter. I was in the shack writing a few letters."

"Thank you. You may go."

Back I went...

"W2AFN, W2AFN, this is W2GYO. Okay, I'm back. Hold on, I want to get a cigarette."

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Turning to reach for the cigarettes, I found the Communications Officer standing there, holding the pack of Lucky Strikes. "SHUT IT DOWN AND REPORT TO THE CAPTAIN'S WARDROOM!"

I got things squared away, lit the cigarette, took a few drags, and went down below. Without going into details, I got thoroughly chewed out and was confined to the ship for 30 days. The only exception to that sentence was being permitted ashore in Shanghai—with the Captain—on December 25 to attend Christmas services.

So began, and ended, my ham radio adventures from the Pacific at the close of World War II. ■

Does Anyone Know the Original W2AFN?

K4JS is interested in contacting the original W2AFN again (legally, this time!), if he is not yet a Silent Key. The current *Callbook* shows that the callsign has been reissued as a vanity call to a ham in Tupper Lake, New York.

Ted guesses that the original W2AFN was probably issued some time around 1928, based on the callsign of a friend of his, originally W2DLO, who received that call in 1931. If any reader knows, or knew, the original W2AFN—he was a major in the Army Air Force in 1945 and ran the US Armed Forces station in Manila—please contact K4IJS at the address listed at the bottom of the first column of this article. *–W2VU*

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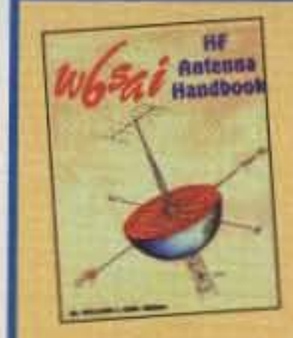

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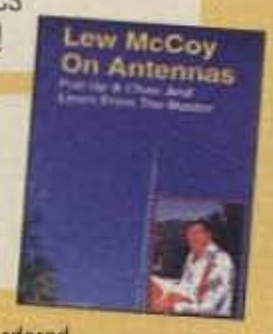

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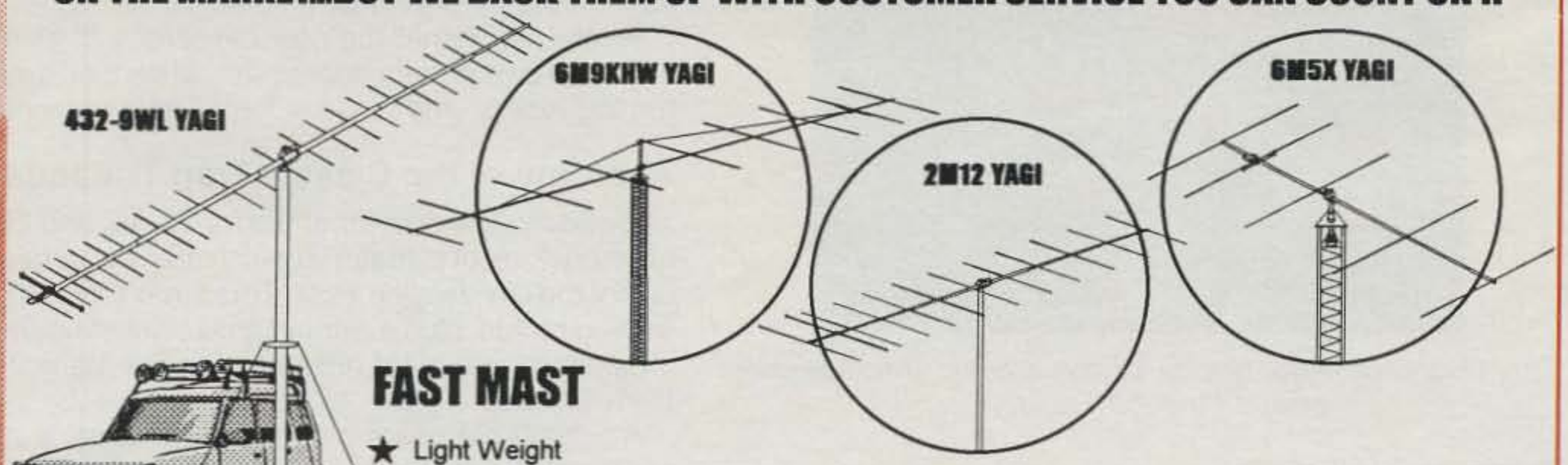

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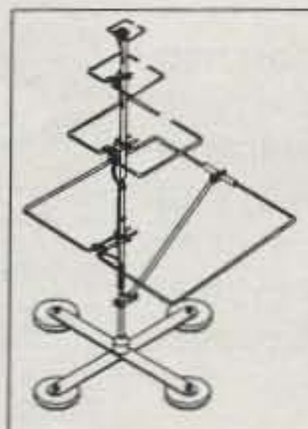

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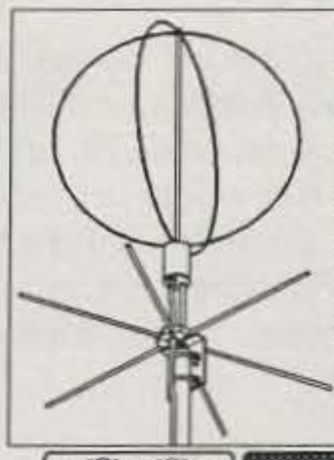

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Antennas

BY ARNIE CORO, CO2KK

Connecting Your Station To The World

The Second Most Popular Amateur Antennas: Triband Yagis for 20, 15, and 10 Meters

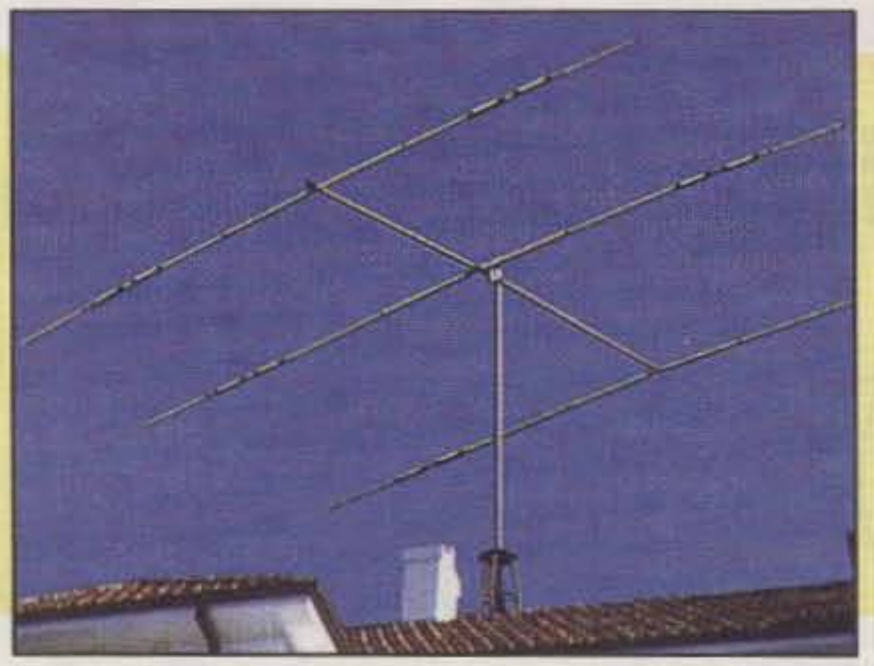
This month's column mainly is aimed at those of you who recently have obtained access to the HF bands. Many nations around the world are reducing their Morse Code speed requirements, thus making those bands available to amateurs who used to be able to work only VHF and UHF bands.

Probably, all of you just starting on the HF bands pretty soon will feel the need for an antenna better than a dipole or a vertical monopole. Here then are a few facts and comments about the second most popular ham antenna worldwide.

If you are an old timer and your triband Yagi needs replacement, time spent reading the column will help you decide how to replace it with a high-tech skyhook! — CO2KK

Triband Yagi type antennas are really popular among radio amateurs around the world. The compact 20-15-10 systems connected to the station via a single coaxial feedline provide a practical and rather low-cost solution for the average operator.

"Some gain over a dipole plus front-to-back ratio and front-to-side ratios." That's how a professional antenna designer described these systems, which started by using traps to isolate sections of the elements and at the same time act as inductive loading at the lower frequencies, but later developed into more sophisticated antennas using capacity end loading, linear loading of elements, log periodic cells, etc.



The Cushcraft A3S is one of the classic three-element trapped triband Yagis.

Traps or Sleeves?

For the newcomer to the HF bands, the typical lower cost trap Yagi tribander offers a quick and easy way to enjoy the peak years of the solar cycle, while an antenna much better than a dipole or a vertical monopole is usable through the lower part of the cycle on the 20 meter band and will be always at hand during those periods when 15 and 10 open up for DX even at the bottom of the cycle! A trap, for the uninitiated, is a capacitor-and-coil (L/C) circuit that is inserted at a certain point in an antenna element. It acts as a stop sign for signals at higher frequencies, while passing signals at lower frequencies, keeping the antenna resonant on multiple bands.

Today's sophisticated computer modeling has improved the triband beam, especially by using newer approaches that replace the traps with open-sleeve elements, a system that only feeds the lowest frequency 14 MHz band element, and drives the 21 MHz and 28 MHz band dipoles by close coupling.

Open-sleeve driven elements may be used in combination with regular traps in the parasitic reflector and director, or may follow a more efficient, but at the same time more costly, approach—that is, using individual parasitic elements for each of the three bands.

Finally, very small log-periodic cells, with as few as five elements, have proven successful, while total antenna weight, turning radius, and cost are kept within reasonable limits.

Anatomy of the Classic Trap Tribander

The classic, low-cost tribander for 20, 15, and 10 meter operation packs a lot of features which are very convenient, above all, for the city dweller. First is the small footprint and reduced turning radius, plus a rather lightweight structure that can be supported by a mast or tower that can be installed at relatively low cost.

A lightweight beam means you can use a standard, less costly rotator, because *you definitely will need to rotate the antenna*. Its horizontal radiation pattern, while not as sharp as a multi-element, long, single-band Yagi, nevertheless will require around-the-compass rotation in order to reach your targets.

A single coaxial feedline connects the typical single driven element to the station, with most of the commercial triband beams including at least a coaxial choke balun decoupler to improve the antenna's horizontal pattern by reducing so-called "feedline antenna currents" which distort the antenna's pattern by combining radiation from the radiating structure itself and the shield of the coaxial cable.

Antenna Gain?

A typical well-designed and built *two*-element triband Yagi will provide no less than 3 dB gain over a standard half-wave dipole—perhaps a bit more. Adding one more element to make it a classic *three*-element beam means that the additional parasitic director will boost the forward gain figure by barely 2 dB more, regardless of what the antenna manufacturers may claim.

However ... on the other hand, a 5 or 6 dB forward gain on three bands, together with maybe 15 or even up to 20 dB front-to-back ratio, will increase your amateur station performance in a most significant way. The ability to turn the antenna *away* from a source of interference is sometimes as useful, or even more useful, than the forward gain.

Finally, installing your triband Yagi at an adequate height will further lower the all-important TOA, or take-off angle, of your signal into the ionosphere significantly, improving results over a standard reference half-wave dipole.

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The Most Popular HF Ham Antennas!

No doubt about this: Wire dipoles in their several different configurations, from the classic half-wave resonant to the G5RV, are the most popular and certainly easiest to install and adjust amateur antennas. Trap dipoles, double-extended Zepps, and others provide the average amateur with the ability to be on the air on the HF bands. Some even provide a small gain, but these are no match for the workhorse of ham antennas—the small, lightweight 20, 15, and 10 meter Yagi antenna.

Some designers include a "real balun" instead of the coaxial choke, and they aim at a driven element feedpoint impedance of around 12 to 15 ohms on all bands that is then matched through a variety of devices such as the hairpin loop, which will step up the impedance to near 50 ohms in a balanced line. Then a 1:1 balun can provide a near-perfect match to the 50 ohm coaxial cable feedline.

The Matter of Boom Length

Boom length is a very important design parameter, as it is this more than anything else that determines the gain of a beam antenna. Designers of lower cost trap triband beams have to establish a compromise in relation to the boom length. Using a very short boom will degrade the performance on 14 MHz, and will make properly matching the driven element a difficult task, to say the least, especially on that band because of the close spacing between elements.

That is why, when you compare commercial trap triband beams in the lower price bracket, you will soon find that they are all within rather narrow boom-length limits. The longer the boom, the more mechanical problems the designer will have to deal with, and higher diameter and more rugged aluminum tubing *must* be used. This in turn will increase the cost of the antenna, making it a less competitive commercial product. Fortunately, there are several very well-designed, compact trap triband beams with short booms, which makes installation on city lots easier by reducing the footprint and turning radius!

To Trap or Not to Trap...

That is a *very good* question! While the technology of designing and building resonant traps has evolved during the past 40 years, the fact remains that traps are the most delicate and vulnerable parts of a trapped triband beam!

Resonant traps can be made using standard high-voltage ceramic capacitors and heavy copper-wire coils, both of which need to be protected from the weather almost perfectly, or the antenna won't work properly even after a very light rain falls all over its metallic structure. Once water enters the traps, corrosion begins and performance will begin to go downhill.

Traps using coaxial capacitors are a definite improvement over the ones using high-voltage ceramic capacitors. Again, however, the problem of providing adequate protection against the weather is not an easy one to deal with. The actual connections between the traps and the rest of the elements are another weak link, and any really good trap triband Yagi will always have stainless steel hardware !

Homebrew Your Trap Triband?

I sincerely won't recommend it, unless you are a combination of top-notch RF design engineer and mechanical genius and have a lot of patience. Each and every commercial triband Yagi is the result of a lot of experimenting, valuable feedback from users all along the antenna's life span, and the accumulated experience of thousands and thousands of operating hours. Homebrewing a triband Yagi can bring a lot of headaches and cost you a lot of money, too, in long trial-and-error processes.

When shopping, look for the most up-to-date designs even if they cost a bit more. Today's technology does have an edge over the classic systems of yesteryear. This means that CCR (closed coupled radiators), linear-loaded elements, and computer-optimized log periodic cells are worthy candidates to consider, especially if you have a high enough budget.

A small but representative survey I ran during October 2000 showed that the average triband Yagi is up and running for no less than five years, with the typical installation still providing excellent results (with proper maintenance, of course) even after 10 or 15 years of service. Act accordingly. You are going to buy an antenna that probably will outlast your present rig and perhaps even its replacement! Keep in mind that spending a little more now may pay off in the long run.

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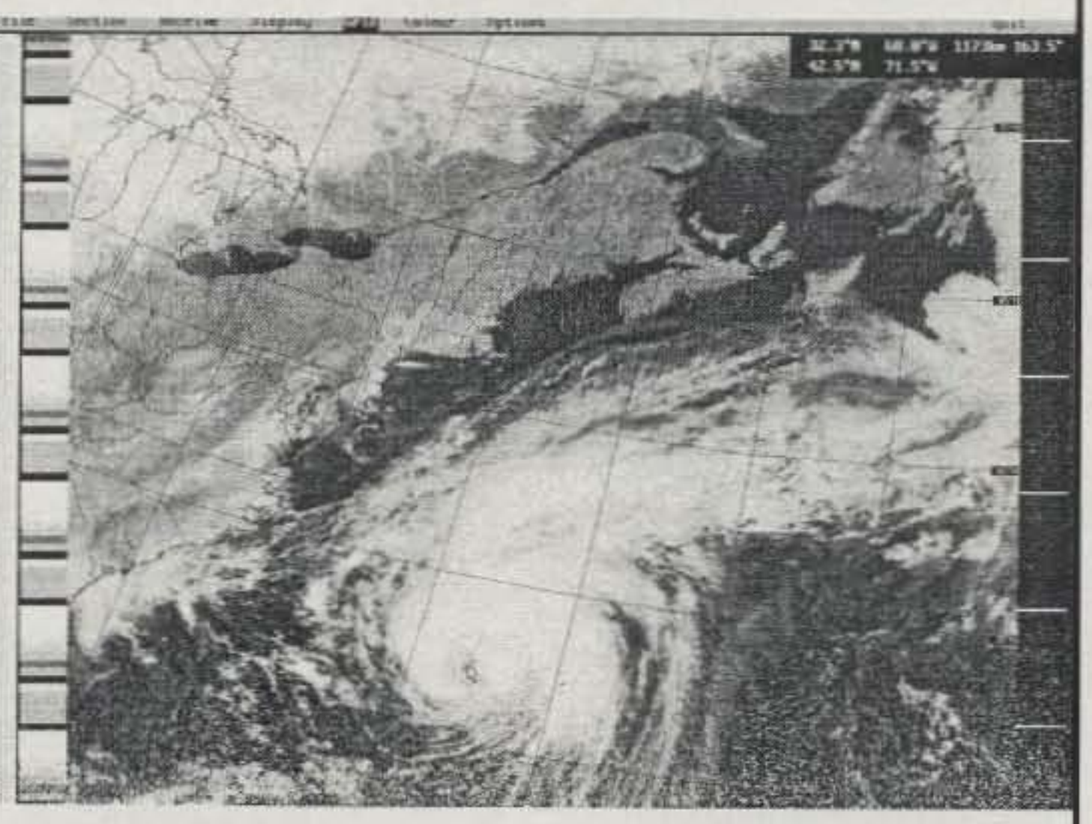

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There are three ways to get a tri-band HF Yagi antenna: buy a new one, build one from scratch, or, as VK6VZ suggests, rescue a used tribander from the trash and restore it to working order.

Restoring HF Trapped Tri-Banders

BY STEVE IRELAND,* VK6VZ

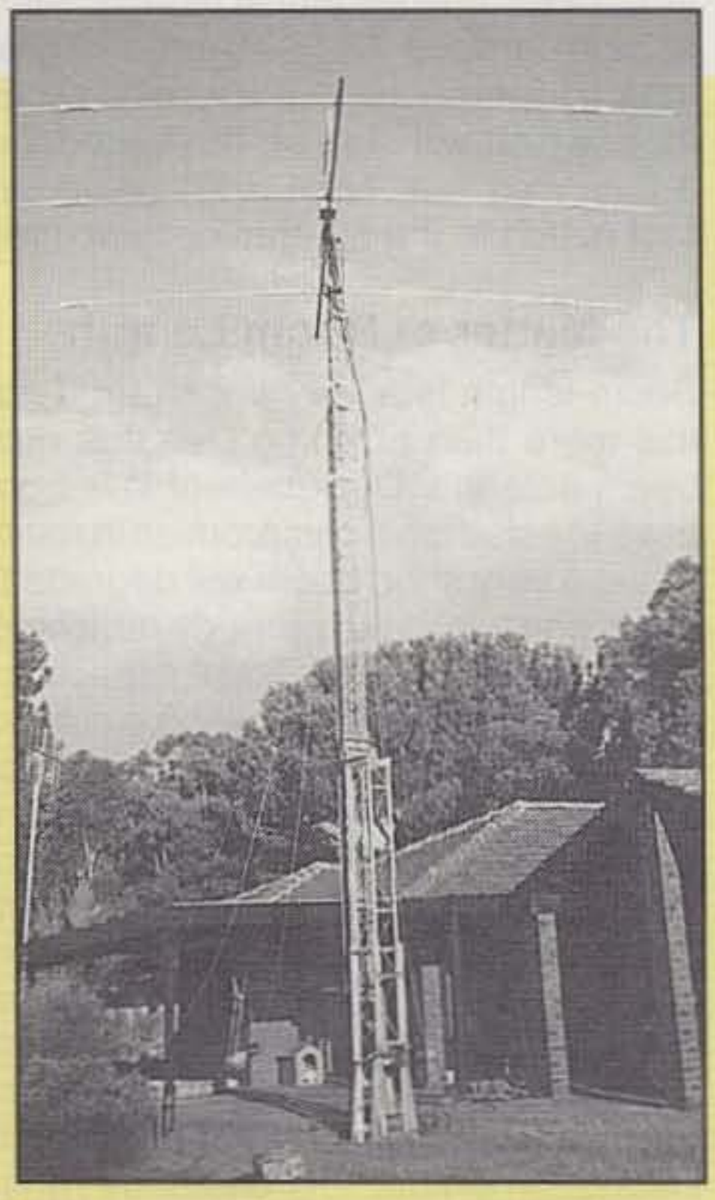
These days, the trapped tri-band Yagi can be a somewhat maligned antenna. What have been the most popular directional antennas for the 14, 21, and 28 MHz amateur bands for the past 30 years are sometimes unfairly dismissed as "rotary dummy loads" and passed over for fancy log-periodic Yagis, trapless beams, or mono-band antennas.

When I first became interested in shortwave listening back in 1970, almost every DX station I picked up on the 14, 21, and 28 MHz amateur bands on my ancient HRO receiver was using a trapped tri-band Yagi, often of the 3-element Hy-Gain TH3 or Mosley TA33 type. If you were a "big gun" DXer, then you had a Hy-Gain TH6DXX 6-element tri-bander instead. You *knew* this must be a really super antenna because it had DX**X**—double DX!—after its model type number. For those interested in motor racing, this transcribed to having a GT grade of antenna!

Those great tri-band antennas from the likes of Cushcraft, Hy-Gain, Mosley, and Wilson spawned a whole heap of budget-priced imitations, made from one end of the globe to the other , which dominated the HF bands for three decades until some started to question their relative efficiency. Now, those radio amateurs who changed from cheap Brand-X tri-band trapped beams to mono-band Yagis quickly deduced that the latter was a much superior antenna. Compromise element spacings and traps with "lossy" small-diameter thin-wired coils were sometimes used in the former, resulting in a poor front-to-back ratio on 14 MHz and relatively poor overall performance on 28 MHz, where the trap losses were usually highest.

Over the last ten years a lot of trapped tri-band Yagis have come down, replaced by the new flavors of beam an-

*P.O. Box 55, Glen Forrest, Western Australia 6071, Australia



The author's rebuilt tri-band trapped Yagi, in the air and on the air, on 20, 15, and 10 meters.

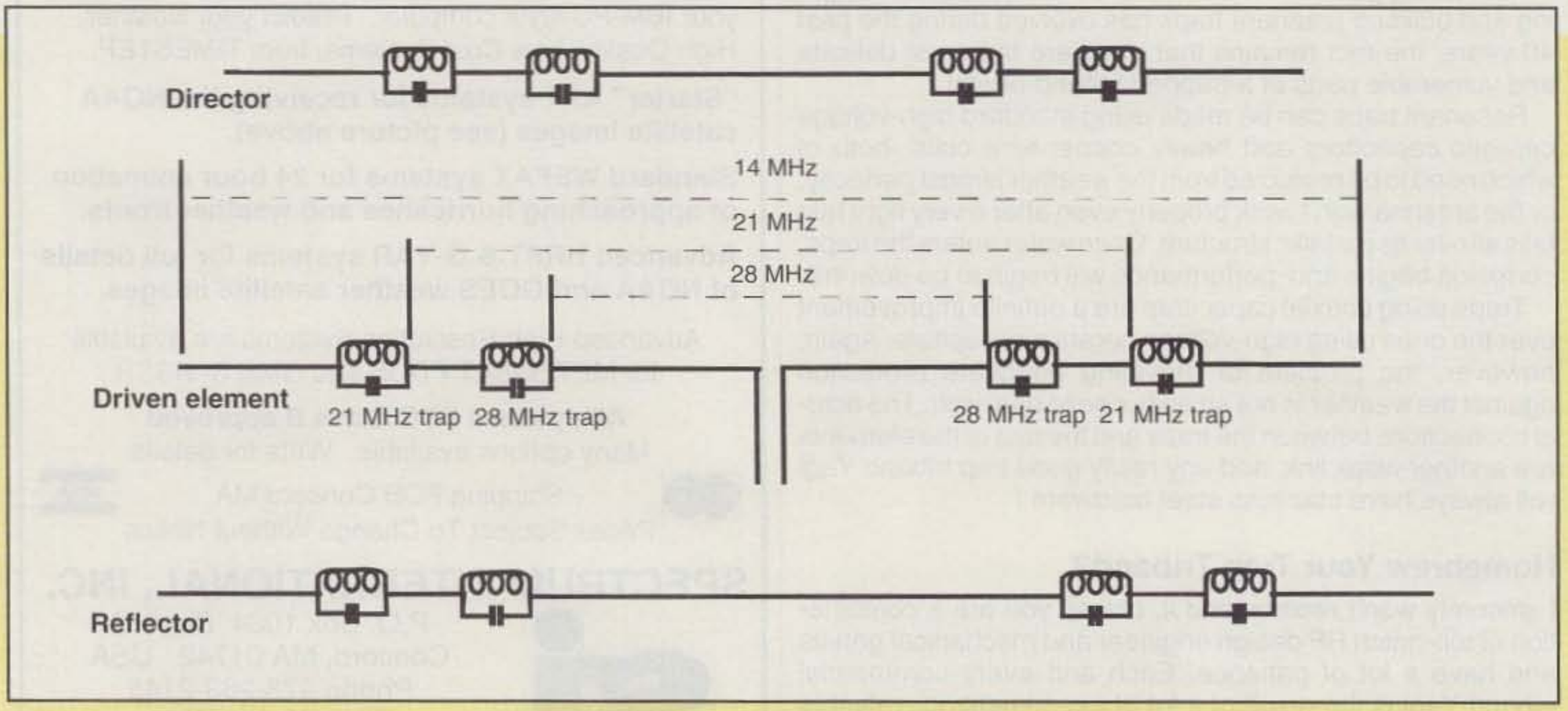


Fig. 1– Circuit of a typical 14/21/28 MHz tri-band Yagi.

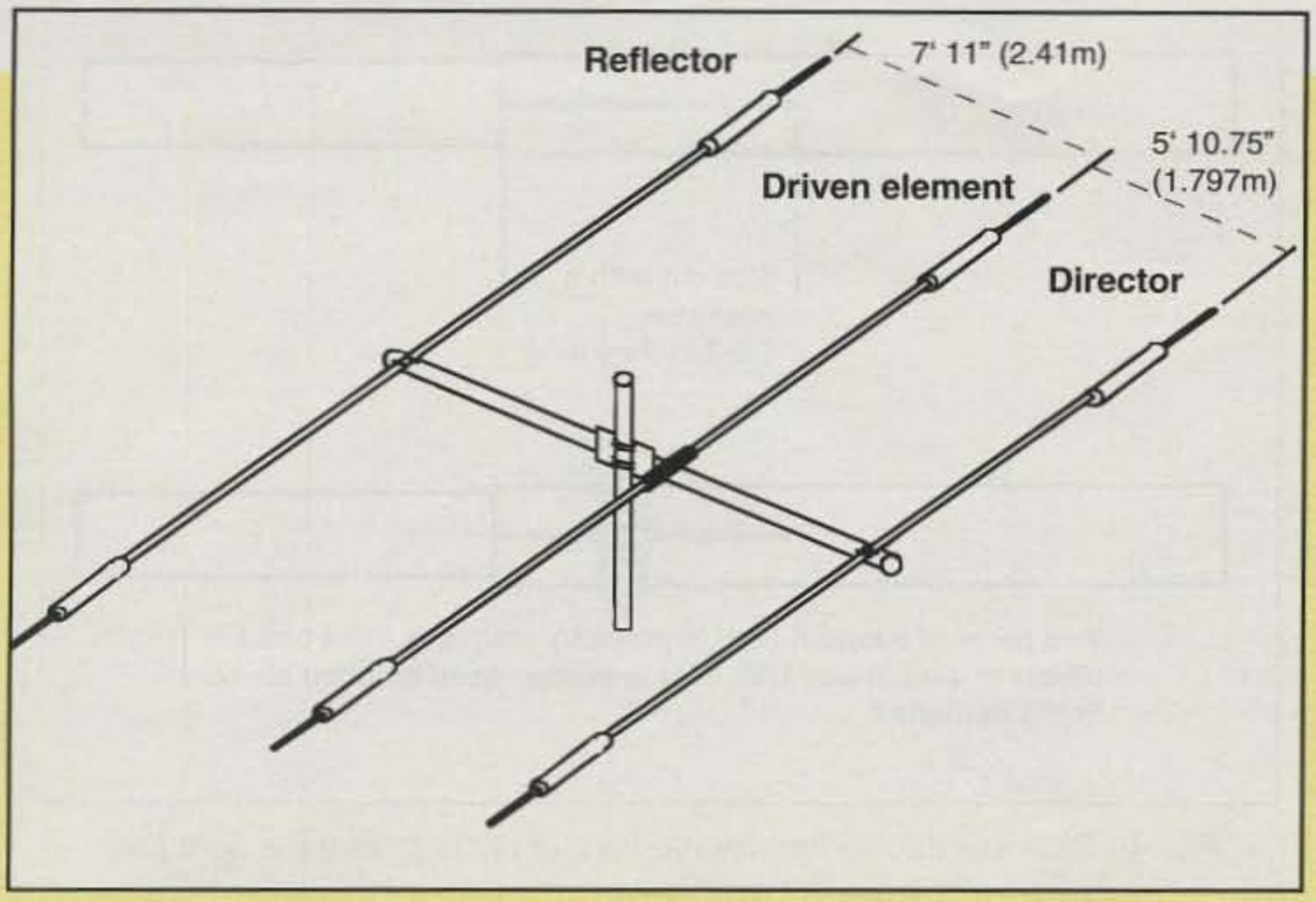


Fig. 2– Wilson System 3 tri-band Yagi element spacing.

tenna, and have ended up in the garage. Sometimes these tri-banders are seen for sale, but often the owner, unsure of the antenna's resale value after 20 years of faithful service, has simply placed it with the rest of the shack scrap metal. Although many old Brand-X trapped tri-banders are probably best left in the scrap pile, high-quality tri-banders such as those made by Hy-Gain, Mosley, Cushcraft, and Wilson Electronics are well worth seeking out and refurbishing.

While they are not going to perform as well as monoband Yagis with similar numbers of elements, used, "quality" trapped tri-banders make excellent HF beam antennas at good prices. As an example of the "good prices" aspect, a friend wanting to clear out his garage recently offered me the elements of a TH6DXX, still working and only needing a bit of a clean-up plus some aluminum tubing for a boom, for a few tens of dollars. This was just after I had purchased a 1970s vintage Wilson System 3 trapped tri-bander for A$250 (US $125), unused for at least the last ten years or so during which time it had languished in the proverbial garage.

In Australia I am well known in the contesting and DXing worlds for my use of large quad and mono-band Yagis. So what am I doing using a tri-band trapped Yagi? The answer is simply that I had to compromise with my 7/14/21/28 MHz antenna setup in order to put up a much better antenna for my favorite band, 1.8 MHz. All trapped tri-band Yagis are compromise antennas. Sometimes radio amateurs have to compromise to save some space—even lucky people like me living on half an acre.

What is a Trapped Tri-Bander?

For the uninitiated, a "trapped tri-bander" is basically a Yagi antenna for 14 MHz which has a couple of parallel tuned circuits in each element half, in order that it will also work on the 21 and 28 MHz bands (see fig. 1). The parallel tuned circuits, or "traps," look like a very high impedance at their resonant frequency, stopping any signals or RF around their resonant frequency from traveling any further along the element than the trap. One useful function of the traps is that they provide inductive loading on 14 MHz, making the antenna smaller than a conventional 14 MHz mono-band Yagi.

The trap coil is usually wound on a form made from high-quality insulating material, while the capacitor in parallel with it is formed by the capacitance that exists between the coil and the aluminum sleeve that surrounds the coil and protects it from the weather. What you have then is an antenna that is effectively a Yagi for each of the three bands. However, the spacing between the antenna elements on a tri-band Yagi is something of a compromise, as it is working on three bands; generally speaking, the element spacing will be a bit too close on 14 MHz, about right on 21 MHz, and too wide on 28 MHz. This results in compromises in performance (in both gain and front-to-back ratio) as compared to mono-band Yagis with a similar number of elements.

In the case of a three-element trapped tri-bander, the traps are positioned in the reflector element so that it looks about five per cent *longer* than the driven element on each band. Similarly, the traps are positioned in the director element so that it looks about five percent *shorter* than the driven element on each band. The 28 MHz trap is the inner one on each element (closest to its center), while the 21 MHz trap is the outer one, and the length of the tips of the antenna (i.e., the part of the element outside of the 21 MHz trap) is adjusted so that the whole element is resonant on 14 MHz (see fig. 1 again).

The other area of compromise with a trapped tri-band Yagi comes in the use/design of the traps. Even the best designed coils—the highest "Q"—used in traps will display some RF series resistance at their resonant frequency, and consequently some RF/signal at this frequency will be lost. Broadly speaking, the higher the Q of the trap coil, the less the series resistance and the lower the losses will be—and the better the trap/antenna will work.

Building the Beast

As I said before, trapped tri-band Yagi antennas have been around for a very long time. As a result, some long-time radio amateurs may have retired at least one tri-bander or simply discard-

Cushcraft Corporation, P.O. Box 4680, Manchester, NH 03108 USA; phone: 603 627 7877; fax: 603 627 1764; e-mail: <hamsales@cushcraft.com>; web: <http://www.cushcraft. com>.

Mosley Electronics Inc., 1325 Style Master Drive, Union, MO 63084; phone: 800 325 4016; fax: 314 583 0890; web: <http://www.Mosley-Electronics.com>.

Hy-Gain Antennas and Rotors: On 10 May 1999, MFJ Enterprises bought Hy-Gain. MFJ says Hy-Gain will remain a separate entity and continue to sell the entire production line that it currently produces, plus new products; phone: 800 647 1800; fax: 601 323 6551; web: <www@hy-gain.com>; <http://ourworld/compuserve.com/homepages/hygain>.

Fig. 3– List of contact information for popular trapped tri-band Yagi makers.

ed it for another antenna, as the result of its age or of damage to the antenna. Those who have an antenna that has been caught in a high wind, hit by falling tree branches (I know all about this one, but that is another story.), or dropped when it was being erected/taken down, almost certainly end up throwing the surviving antenna elements in the garage somewhere.

Even if you can't find a whole high-quality tri-band Yagi to restore, you can experiment and make an antenna Dr Frankenstein-fashion from a couple of damaged specimens —preferably from the same manufacturer! However, if you are really feeling radical, I suppose you *could* try elements made by different manufacturers (although on reflection, I have my doubts about this approach...). Imagine the talking point the antenna would be on the air: "Using a three-element trapped tri-band Yagi here, made from some spare parts. The reflector is by Cushcraft, the driven element by Mosley, and the director by Hy-Gain. By the way, the name here is Igor."

Joking aside, the best way to pick up "retired"' tri-band Yagis is to ask around the local amateur radio club or hamfest. You could always try a "wanted" advertisement in the classified pages of this very magazine, too!

A note of caution here: In addition to avoiding old Brand-X trapped tri-band antennas, I would also probably avoid all "Junior" versions of tri-band beams, whoever the manufacturer. Although these "Junior" antennas have a good reputation, the power handling and mechanical arrangements of their traps are usually much less substantial than those of the "Senior" counterparts. The philosophy here is similar to the one that says if you are buying an old second-hand car that may have had a lot of use, always go for the high-end model, as this usually will have been built to last longer than the low-end one.

For example, the traps on my Wilson System 3 are almost double the diameter of those of a Junior-type trapped tri-bander I saw and look twice as rugged and a mere fraction as burnt. This reminded me of when I was a teenage radio amateur in the United Kingdom and operated in the local radio club's SSB Field Day team. Considerable annoyance was vented upon me and my fellow young contesting tear-aways by a senior club member when he discovered we had fried the traps in the club's Junior tri-bander using an old linear amplifier with a couple of half-dead 572B tubes in it.

When you are buying a second-hand tri-bander, take a screwdriver with you so you can take off the end caps and covers off a trap in each side of the driven element. A good look at the trap coils/forms for any signs of burning/serious water damage is a good idea. Also, if the wire diameter is any thinner than 14 AWG (preferably it should be more like 10 or 12 AWG), find yourself another tri-bander to buy.

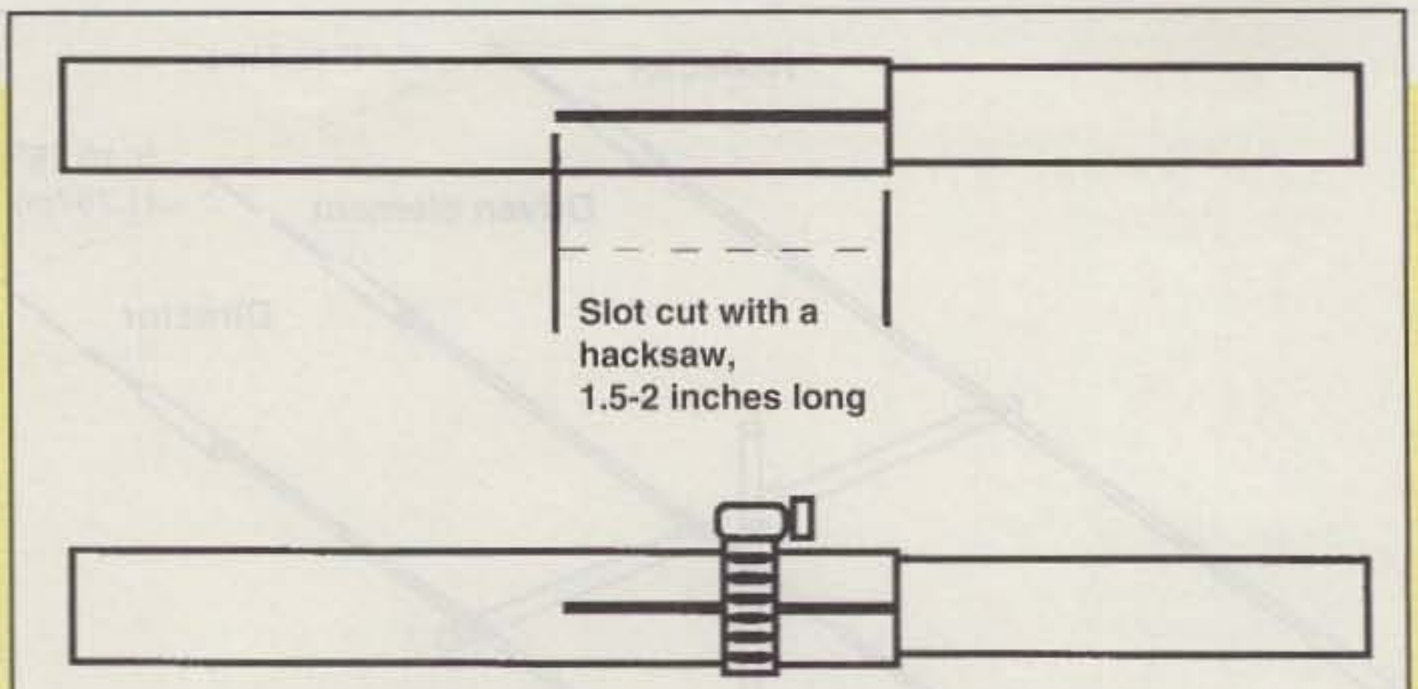
Incidentally, always inspect the driven element traps, as these have to carry more power than the ones in the reflector or director elements and are thus more likely to have experienced burning/overheating. The major reason why a trap in a tri-bander overheats apparently has to do with the aluminum trap cover forming a single-turn coil which is an electrical short circuit; when RF is passed into the trap, the trap cover heats-up[1] even if you are only running modest power!

When it comes to price, this is a tricky area. My Wilson System 3 cost me $A250 (about US$125), which was a fair price for a tri-band antenna that looked a lot younger than its 20-plus years of age, as it had sat in a garage for much of this time. Don't worry too much about the age of the antenna as long as it looks in good condition and is a "quality" antenna.

Getting spare parts for old tri-band antennas from Mosley, Cushcraft, and Hy-Gain should not be too much of a problem, as there are plenty of these antennas around. If you can't find any secondhand spares/broken antennas to cannibalize, fig. 3 gives a list of web sites/addresses for the major trapped tri-band manufacturers, so you can check to see if they still have spares available for particular antennas.

When it comes down to it, most of the antenna parts in a typical tri-bander are aluminum and thus rugged unless dropped, while any parts that are plastic or rubber and need replacement can usually be fabricated using bits and pieces from the local hardware store (if they can't be obtained from the manufacturer or another radio amateur).

Incidentally, I was kindly sent several trap end-caps for my Wilson System 3 by an acquaintance in the USA. His old antenna had been struck by lightning some 15 years before and ended up in the garage! Another North American acquaintance found a source of Wilson trap covers and even bought some for me.



Two parts of element held in place by stainless steel hose clamp or similar-see text. Slot is compressed by hose clamp being tightened.

Fig. 4– Slots cut into tri-bander element in order to make a tight joint.

Refurbishing a Tri-Bander

The first thing to do after making your purchase is to read the antenna handbook carefully to check how it is assembled/disassembled. Without this kind of familiarization, it is hard to carry out a re-build. The next thing to do is to clean any "white rust" off the antenna's aluminum elements using wire wool and/or emery/sandpaper. This is a messy, tedious business, and while not strictly necessary, it will give the antenna that nice "brand-new" look when complete.

Now look at the joints that are made along each antenna element, held together with compression-type clamps. Check to see that the part of the element that forms the outer part of a telescoping joint has a slot cut into it, as shown in fig. 4.

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If you have any joints in the elements which do not have a slot in them and rely purely on the pressure exerted by the clamp "squashing" the outer tube against the inner one, you could try carefully cutting a 1.5 to 2 inch long slot into the outer one with a hacksaw blade (just a hacksaw blade's-width slot—i.e., make a single cut with a hacksaw blade —see fig. 4). This allows a larger area of the outer tube to press against the inner one and thus make a much better electrical connection.

It is my experience that the electrical conducting properties of an unslotted compression joint will deteriorate rapidly over time, causing arcing to take place when RF is applied to the antenna and causing the antenna's performance to be drastically impaired.

The next thing to do is to replace all the galvanized steel nuts/bolts/clamps on the antenna with similar-sized stainless steel hardware. On my Wilson System 3, in common with other tri-banders, the antenna elements consist of several telescoping aluminum tubes, secured with aluminum clamps, which are (in turn) held in place with galvanized steel screws/nuts.

After a few years in the air, especially if the antenna has been previously sited near the ocean, the galvanizing will have completely deteriorated and the steel become very rusty. Rusty steel nuts/bolts/clamps on antenna elements carrying RF energy can lead to very bad television interference, and the rusty steel may break in a high wind, causing the antenna element concerned to fall to the ground.

In my case, I opted for the cheapest solution, which was to buy metric-sized stainless steel nuts and bolts and replace the imperial-sized galvanized ones in the clamps. This required me to drill out the holes in each element clamp, in order to fit the slightly larger diameter metric screws.

A simpler but more expensive option would have been simply to replace each clamp assembly with a stainless steel hose clamp. Incidentally, if you do this, make sure you buy clamps which actually use a stainless steel screw in them. In my experience, most of the ones available from garages in VK-land seem to use a galvanized steel clamping screw, which can quickly deteriorate.

Replacing all the hardware on my Wilson with stainless steel cost me around A$100 (US$50). This may seem a lot, but I know that the antenna is good for another decade at least, without worrying about hardware at all. The same hardware in galvanized steel would probably have set me back around a quarter of this price, but might have only lasted about a year or two before getting rusty.

Battle of the Parrots

On my particular antenna there are only four pieces of hardware which are not either aluminum or stainless steel— the trap end caps, the element end caps, the coil forms, and the insulators on the driven element. Of these, the latter two are not exposed to the elements and were thus in excellent condition, even considering the age of the antenna, and did not require replacement.

On the other hand, the trap end caps of the antenna were falling to bits, as the result of being exposed to the sun's ultraviolet rays and parrots snacking on them *(a distinctly Australian problem, we suspect!—ed.)*. Fig. 5 gives an idea of what they looked like. These end caps are vital and stop moisture from entering the traps in large quantities, which can cause parts of the traps to short out, causing a high SWR and much wailing and gnashing of teeth.

My first idea was to try to get some new or used trap end caps, and thanks to several USA friends from the 1.8 MHz band I was able to achieve this. However, during my searches I came across another cheaper and very clever solution from an old copy of the Wireless Institute of Australia's *Amateur Radio* magazine.[2]

Once the traps have been cleaned, the type of trap written on the trap cover with an indelible marker (more on this later), and the trap covers replaced, the trap end covers can be replaced by 2 inch (50 mm) lengths of suitable diameter heat shrink tubing. Once the heat shrink has been shrunk, it will take a very sharp knife to remove it, so do all your trap renovation work first! According to the article, the new end covers should stay waterproof and stand up to UV for at least five years, with little or no deterioration.

However, coming back to the renovation of the traps themselves, make sure all dirt/moisture/ is cleaned from the trap coils/inside of the trap covers and reassemble them, *making sure the traps are in the right element and are the right way around*. If a reflector trap is put into a driven element or director by mistake, the antenna won't work too well.

Also, many tri-band traps—my Wilson System 3 traps included—actually contain two traps in each assembly, one for 28 MHz and one for 21 MHz. Unless the

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trap is placed in the element with the 28 MHz trap closest to the antenna boom, the antenna will also not work too well!

By the way, do not assume the antenna's previous owner had actually assembled the antenna correctly, with the right traps in the right places. I know of several instances when trapped tri-banders have been taken down because the antenna has refused to function properly, only for the owner or subsequent owner to find that the traps had been placed in the wrong element or the wrong way around.

If you have two traps in one trap assembly, using the antenna's handbook/instruction sheet, check which trap is which and mark its name/orientation on the trap cover (i.e., "Reflector" with an arrow marked at the 28 MHz end, pointing towards the boom). In the case of a tri-band antenna with separate trap assemblies for 28 MHz and 21 MHz, clearly mark each one (i.e., "21 MHz reflector trap" '28 MHz reflector trap," etc).

Do take your time cleaning/refurbishing the antenna. I refurbished my Wilson System 3 over the course of the autumn, spending a couple of hours on it each weekend. It is a dirty job, but if done in this fashion does not seem too unpleasant.

A final note: *Do not attempt to straighten any bent aluminum antenna elements or restore any creases or crushes in them.* These damaged parts must be replaced with ones of the same specification. Aluminum loses its strength once it has been bent, creased, or crushed and can easily break.

Rebuilding the Beast

Once the aluminum elements, clamps, and traps have been cleaned/refurbished, the traps carefully checked to ensure they are the right way around and in the correct antenna element, it is time to set the lengths of the elements so the antenna will work at its optimum in the part of the 14/21/28 MHz bands you use the most.

The instruction sheets/handbooks of most tri-band Yagi antennas will contain two sets of dimensions, one for the CW parts of the bands and the other for the SSB sections. They will also usually contain graphs of the SWR of the antenna for each set of dimensions, plotted across the individual bands from one end to the other (i.e., 14.0 to 14.35, 21.0 to 21.45, and 28.0 to 29.7 MHz).

In my case, being mainly a CW operator, it was an easy choice and my antenna was set up using the set of "CW settings" provided by Wilson. However, if you are an operator who uses both modes, even if mainly SSB, do take a careful look at the SWR curves and consider setting the antenna up using the CW settings.

Fig. 5– Wilson System 3 trap before re-build, showing end caps eaten by parrots.

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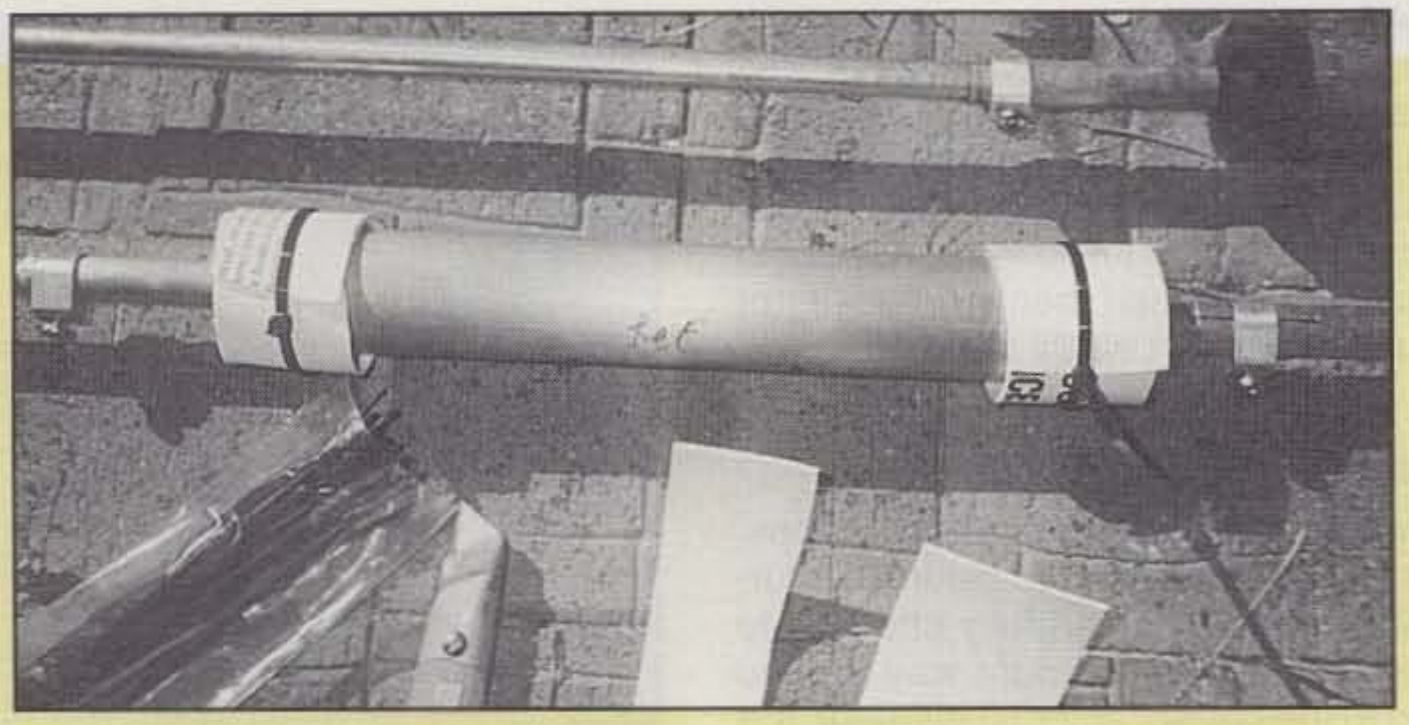

Fig. 6– Parrot-proofed tri-band trap.

In my experience, a tri-band antenna that is set up for the CW parts of the bands will generally have a relatively low SWR and work well over the SSB sections of the 14/21/28 MHz bands (with the possible exception of the upper 1 MHz of 10 meters). However, a tri-bander set up for SSB will often show a high SWR and poor performance at the CW end of the bands. This is because a 3-element beam which has reflector and director elements that are slightly short for the frequency in use (i.e., a tri-bander set up for the SSB segments being used in the CW segments) will usually perform a lot worse than one whose reflector and director elements are slightly long for the frequency in use (i.e., a tri-bander set up for the CW segments being used in the SSB segments). If you are interested in mainly operating at the high end of the SSB segments or are interested in 29.6 MHz FM operation, the SSB settings will definitely be the ones to use.

Once you have measured the antenna and set the element lengths, take the tape measure and recheck them again, preferably after a few minutes' break. As I said before, an awful lot of tri-banders have ended up at the back of the garage because they weren't measured/set up properly and consequently performed poorly.

Once you have done this, carefully mark the element joints in each element with an indelible marker and undo one of them. Ensuring both connecting surfaces are clean and free of any "white rust," spread a thin layer of aluminum electrical jointing compound (such as Alminox or Penetrox) on each surface and replace the two element parts and do up the clip that holds them together. Repeat this process with every joint and all the elements. Once the elements are complete again, re-check the measurements yet again.

One other thing to bear in mind: I have heard of a case where a manufacturer's assembly handbook for a tri-band Yagi allegedly contained incorrect element length data (possibly due to a typographical error). If you find your antenna does not work correctly and the element measurements seem correct (get a friend to help you check them!) you may need to get in touch with the man-

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ufacturer to check that all is well with the instruction sheet/handbook.

Final Touches

To finish off the antenna elements, go to a local automotive shop and buy a can of Valvoline Tectyl 151 spray to proof the antenna against "white rust." Making sure you have first masked the rubber/plastic trap end covers, spray each antenna element with the Tectyl 151 from end-to-end, with at least a couple of coats. Your antenna will look like new, even after a few years in the air.

If you are pushed for money and have a tin of good-quality outdoor-type varnish in the shed, you could coat the antenna elements with this instead.

If you have birds in your area which like to chew on plastic (such as Australian galahs!), you probably need to "bird proof" the antenna trap covers. The antenna trap covers are vital in stopping moisture from getting into the traps and so are well worth protecting.

This involves getting an old swimming pool chlorine bucket and cutting it into strips about 10 cm wide with a hacksaw or modeling knife. Wrap one of the strips around a trap end cap in the manner shown in fig. 6, cut it to length so there is a couple of centimeters overlap and hold it in place with a black UV-resistant cable tie. Repeat the process for all the end caps.

Once you have done this, the next thing is to attach the antenna elements to the boom. Measure and mark the places where the elements should go and clean everything—the elements, the boom, and the boom-to-element clamps—thoroughly to get rid of rust of any kind and coat them with aluminum jointing compound. Now mount the elements onto the boom and check those measurements again!

With regard to feeding most tri-banders, the driven element is usually split at the boom and slid inside a rubber/plastic insulating sleeve. If the rubber/plastic sleeve is split or cracked, preferably it should be replaced, but if a replacement cannot be obtained, it usually can be repaired/held together with a single layer of black insulating tape.

If there is a balun with the antenna, my advice is to discard it and replace it with a new choke balun made of 15 turns of RG213 coaxial cable wound on a 2 liter soft-drink bottle (which is securely cable-tied to the antenna boom), or a W2DU-type ferrite bead choke balun.[3] One never knows what misdeeds may have been done to the original balun, and as these are usually sealed devices and thus impossible to inspect, it is usually best to start from scratch. Note that the latter ferrite bead balun is probably the more effective one of the two, but for those short of cash, the former should also work okay. The tri-band beam should be fed with "mil-spec" RG213 50 ohm coaxial—no scrimping here!

Finally, make sure that you use self-amalgamating tape or Coax Seal® on all antenna feed-line/balun connections to keep out the moisture, protecting the self-amalgamating tape with several layers of black insulating tape. The insulating tape, in turn, protects the self-amalgamating tape from the sun's harsh UV rays.

On my installation I further protect my antenna feeder where it joins the tri-band feed-point using strips of the swimming pool chlorine bucket used earlier. The galahs around here just love eating my coaxial cable!

As a finishing touch, if the element end caps are in need of replacement, black plastic "chair tips" (used to tip the legs of metal chairs) from the local hardware store do an excellent job. I use 5/8 inch (15 mm) diameter chair tips on the elements of my Wilson System 3 and they only cost a few tens of cents each.

Conclusions

Rebuilding an old high-quality tri-bander such as a Wilson System 3, Cushcraft A3S, Mosley TA33 Senior, or Hy-Gain TH3 Senior can be both cheap and fun to do. During the next few years, with the sunspots doing their stuff, a good old trapped tri-bander is going to be fun and much more competitive DX antenna than a multi-band vertical or dipole.

Ask local radio amateurs to see if someone has one hidden in the garage. You might be surprised!

References

1. *The V5 Antenna* by Dick Bird, G4ZU/F6IDC, Amateur Radio Action Antenna Book No. 5.

2. "The Ups and Downs of TH3JR Repairs," by Gerry Wild, VK6GW, *Amateur Radio,* December 1995.

3. Ferrite bead baluns were originally described by Walter Maxwell, W2DU, in *QST,* March 1983. Further details are given on page 26–11 of *The ARRL Antenna Book,* 15th edition.

4. Article is based on material published in the Australian magazine *Radio and Communications,* Dec. 1999. ■

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BY CARL SMITH, N4AA

News Of Communication Around The World

Year 2000 in Review

Was 2000 really the millennium year or is it really 2001? Well, regardless of your opinion on that one, you must agree that at least for DXers, the year 2000 was one of the best ever!

Month by Month

January: VKØMM was active from hard-to-work Macquarie Island. He is about to conclude his year on the island as this is written, to return home and begin the huge task of getting QSL cards ready for the thousands of contacts he made while there. Alan has steadfastly refused to give any indication of how to request a card until he gets back to Australia. That information will be publicized via all of the usual news outlets as soon as it is available. Remember that the contacts he made as AXØLD may be confirmed via Brazil.

XZØA made a huge effort from Myanmar with unbelievable antennas systems for the low bands. They did a very commendable job on the upper bands as well, but the low-band effort was particularly outstanding.

VP6BR from Pitcairn Island earned Jukka, OH2BR, the DXpeditioner of the Year award at Dayton. He spent nearly three months on the island handing out QSOs on every band, including an excellent effort on 6 meters.

9U5D was active from Burundi for about three months, starting in January. Gus was very active and provided the first "legal" 9U contacts for a long time.

Roger, G3SXW, and Nigel, G3TXF, took a little trip to Mayotte (FH) and the Seychelles (S79) late in January and turned in nearly 22,000 QSOs from FH and another 4500 from S79—all CW contacts.

February: February brought us operations from VK9C, Cocos Keeling; A22EW, Botswana; ZK2, Niue; VK9X, Christmas Island; CEØZ, Juan Fernandez; CEØY, Easter Island; and ET3, Ethiopia.

March: March saw the resignation of Bill Kennamer, K5FUV, as the Membership Services Manager at the ARRL. Bill had joined the ARRL staff in 1992 and

Chang Jiang San Xia, BD9BD at riverside. Chang frequents 15 meter SSB. (Photo courtesy Fred Laun, K3ZO)

spent several years as the head of the DXCC program.

FOØAAA, Clipperton Island saw action after a number of years climbing the Most Wanted lists. With over 50,000 contacts, Clipperton is sure to drop dramatically on those lists.

An operation from Revilla Gigedo (XF4) provided much-needed contacts with that entity. Some problems with QSLing developed after the operation, but that was resolved with assistance from Mexican authorities.

Andy, G4ZVJ, spent some time in Ghana as 9G5VJ, always a good catch. Andy is such a super operator that he seems to make his own propagation at times.

TXØDX from Chesterfield Reef came up late in the month, providing DXers with an *all-time new one*. Martti Laine, OH2BH, and friends did their usual great job of providing as many unique contacts as possible, choosing this over massive numbers of multi-band contacts. The operation ended with over 72,000 contacts, including over 2500 on 6 meters and 800 on RTTY.

Another new one was 4W, East Timor. With a not totally unexpected announcement on March 13, East Timor was granted "separate entity" status as the ITU authorized the prefix block 4WA–4WZ for use by radio stations within the areas administered by the United Nations Temporary Administration of East Timor (UNTAET). Almost immediately we saw 4W6UN and

The WPX Program

SSB

2771.....W1TE 2773.....N8WRL
2772.....VE6ZT 2774.....WA2RP

Mixed

1867.....KB4VHW 1869.....N8WRL
1868.....W1TE

CW

3047.....W1TE 3049.....VE6ZT
3048.....NØTM

CW: 550 NØTM. 650 E4/G3WQU, VE6ZT. 800 PY5FBG. 1050 W1TE.

SSB: 350 N8WRL. 400 N8WRL. 950 W1TE.

MIXED: 550 N8WRL. 700 EA6BE. 1400 W1TE. 3200 HA5DA.

10 meters: W1TE
15 meters: W1TE
20 meters: W1TE
40 meters: W1TE, 4X0/G3WQU
80 meters: W1TE
160 meters: W1TE

Asia: W1TE, EA5CFZ
Africa: W1TE
N. America: W1TEX
S. America: W1TE
Europe: W1TE, EA5CFZ
Oceania: W1TE

Award of Excellence Holders: K6JG, N4MM, W4CRW, K5UR, K2VV, VE3XN, DL1MD, DJ7CX, DL3RK, WB4SIJ, DL7AA, ON4QX, 9A2AA, OK3EA, OK1MP, N4NO, ZL3GQ, W4BQY, IØJX, WA1JMP, KØJN, W4VQ, KF2O, W8CNL, W1JR, F9RM, W5UR, CT1FL, W8RSW, WA4QMQ, W8ILC, VE7DP, K9BG, W1CU, G4BUE, N3ED, LU3YL/W4, NN4Q, KA3A, VE7WJ, VE7IG, N2AC, W9NUF, N4NX, SMØDJZ, DK5AD, WD9IIC, W3ARK, LA7JO, VK4SS, I8YRK, SMØAJU, N5TV, W6OUL, WB8ZRL, WA8YM, SM6DHU, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, DK4SY, UR2QD, ABØP, FM5WD, I2DMK, SM6CST, VE1NG, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, HA8XX, K7LJ, SM3EVR, K2SHZ, UP1BZZ, EA7OH, K2POF, DJ4XA, IT9TQH, K2POA, N6JV, W2HG, ONL-4003, W5AWT, KB0G, NB9CSA, F6BVB, YU7SF, DF1SD, K7CU, I1PO, K9LNJ, YBØTK, K9QFR, 9A2NA, W4UW, NXØI, WB4RUA, I6DQE, I1EEW, I8RFD, 0<None>I3CRW, VE3MC, NE4F, KC8PG, F1HWB, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, KC7EM, YU1AB, IK2ILH, DEØDAQ, I1WXY, LU1DOW, N1IR, IV4GME, VE9RJ, WX3N, HB9AUT, KC6X, N6IBP, W5ODD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, WØULU, K9XR, JAØSU, I5ZJK, I2EOW, IK2MRZ, KS4S, KA1CLV, KZ1R, CT4UW, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, OE1EMN, W9IL, S53EO, DF7GK, I7PXV, S57J, EA8BM, DL1EY, KØDEQ, KUØA, DJ1YH, OE6CLD, VR2UW, 9A9R, UAØFZ, DJ3JSW, HB9BIN, N1KC, SM5DAC, RW9SG, WA3GNW, S51U, W4MS, I2EAY, RAØFU, CT4NH, EA7TV, W9IAL, LY3BA.

Award of Excellence with 160 meter Endorsement: K6JG, N4MM, W4CR2, N5UR, VE3XN, DL3RK, OK1MP, N4NO, W4BQY, W4VQ, KF2O, W8CNL, W1JR, W5UR, W8RSW, W8ILC, G4BUE, LU3YL/W4, NN4Q, VE7WJ, VE7IG, W9NUF N4NX, SMØDJZ, DK3AD, W3ARK, LA7JO, SMØAJU, N5TV, W6OUL, N4KE, I2UIY, I4EAT, VK9NS, DEØDXM, UR1QD, AB9O, FM5WD, SM6CST, I1JQJ, PY2DBU, HI8LC, KA5W, K3UA, K7LJ, SM3EVR, UP1BZZ, K2POF, IT9TQH, N8JV, ONL-4003, W5AWT, KBØG, F6BVB, YU7SF, DF1SD, K7CU, I1POR, YBØTK, K9QFR, W4UW, NXØI, WB4RUA, I1EEW, ZP5JCY, KA5RNH, IV3PVD, CT1YH, ZS6EZ, YU1AB, IK4GME, WX3N, WBØDD, IØRIZ, I2MQP, F6HMJ, HB9DDZ, K9XR, JAØSU, I5ZJK, I2EOW, KS4S, KA5CLV, KØIFL, WT3W, IN3NJB, S50A, IK1GPG, AA6WJ, W3AP, S53EO, S57J, DL1EY, KØDE1, DJ1YH, OE6CLE, HB9BIN, N1KC, SM5DAC, S51U, RAØFU, UAØFZ, CT4NH, W1CU, EA7TV, LY3BA.

Complete rules and application forms may be obtained by sending a business-size, self-addressed, stamped envelope (foreign stations send extra postage if airmail desired) to "CQ WPX Awards," P.O. Box 593, Clovis, NM 88101 USA.

P.O. Box DX, Leicester, NC 28748-0249
e-mail: <n4aa@cq-amateur-radio.com>

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5 Band WAZ

As of September 30, 2000, 540 stations have attained the 200 zone level and 1163 stations have attained the 150 zone level.

New recipients of 5 Band WAZ with all 200 zones confirmed:
5B4ADA 9A7V

The top contenders for 5 Band WAZ (zones needed, 80 meters):

N4WW, 199 (26)
W4LI, 199 (26)
K7UR, 199 (34)
WØPGI, 199 (26)
W2YY, 199 (26)
VE7AHA, 199 (34)
IK8BQE, 199 (31)
JA2IVK, 199 (34 on 40m)
ABØP, 199 (23)
KL7Y, 199 (34)
NN7X, 199 (34)
OE6MKG, 199 (31)
IK1AOD, 199 (1)
DF3CB, 199 (1)
F6CPO, 199 (1)
W3UR, 199 (23)
KC7V, 199 (34)
GM3YOR, 199 (31)
VO1FB, 199 (19)
KZ4V, 199 (26)
W6DN, 199 (17)
W6SR, 199 (37)
W3NO, 199 (26)
K4UTE, 199 (18)
K4PI, 199 (23)
HB9DDZ, 199 (31)
HB9BGV, 199 (31)
N3UN, 199 (18)
K4IQJ, 199 (23)
K3NW, 199 (23)
UA3AP, 199 (6)
OH2VZ, 199 (31)
K2UU, 199 (26)
W1FZ, 199 (26)
K9GX, 199 (26)
UT4UZ, 199 (6)
SM7BIP, 199 (31)
EA5BCX, 198 (27,39)
G3KDB, 198 (1,12)
KG9N, 198 (18,22)
KØSR, 198 (22,23)
UA4PO, 198 (1,2)
JA1DM, 198 (2,40)
9A5I, 198 (1,16)
K4ZW, 198 (18,23)
LA7FD, 198 (3,4)
K5PC, 198 (18,23)
VE3XO, 198 (23,23 on40)
K4CN, 198 (23,26)
KF2O, 198 (24,26)
W6BCQ, 198 (37,34on40)
G3KMQ, 198 (1, 27)
DL3JJ, 198 (19&31 on 10)
W5BOS, 198 (18,23)
N2QT, 198 (23,24)

The following have qualified for the basic 5 Band WAZ Award:
RU9TU (172 zones) SV1RK (198 zones)
SM7BIP (199 zones)

Endorsements: N2QT (198 zones)
HC8N (192 zones) NT5C (200 zones)

****Please note: Cost of the 5 Band WAZ Plaque is $80 ($100 if airmail shipping is requested).**

Rules and applications for the WAZ program may be obtained by sending a large SAE with two units of postage or an address label and $1.00 to: WAZ Award Manager, Paul Blumhardt, K5RT, 2805 Toler Road, Rowlett, TX 75089. The processing fee for all *CQ* awards is $6.00 for subscribers (please include your most recent *CQ* mailing label or a copy) and $12.00 for nonsubscribers. Please make all checks payable to Paul Blumhardt. Applicants sending QSL cards to a *CQ* checkpoint or the Award Manager must include return postage. K5RT may also be reached at e-mail: <k5rt@cq-amateur-radio.com>.

4W6MM on the air handing out valued contacts with yet another new one for 2000. Additional operations soon after provided more than ample opportunity to work East Timor.

April: BQ9P from Pratas Island was active for a week early in the month. This one always attracts a lot of attention, and this operation was no exception. They provided a lot of RTTY activity this time, thereby pleasing the digital mode gang.

The Visalia International DX Convention 2000 was held in mid-April and was well attended by DXers from all over the US and many DX locations.

There were operations from San Felix (CEØZ) and Western Sahara (SØ). HV5PUL was on from the Vatican and VK9LEH from Lord Howe and a number of other less "needed" entities.

Zhu, BD6QBL, at his station in Wuhan. Zhu can be found most days on 21400 SSB. (Photo courtesy K3ZO)

Geng, BD4IBH, works the world with his 15 watt homebrew CW rig and dipole antenna on 15 meters. (Photo via K3ZO)

May: This was the month that saw the opening up of Bhutan (A5) to amateur radio. A long-planned operation by a large group began on May 3 and concluded on May 12. During their stay the team racked up over 82,000 contacts as A52A. While propagation was not favorable to many areas of the US, the team did as well as could be expected under those conditions. QSL cards were already printed when the operation ended, and QSL requests were being answered within a few days after the team returned home. In addition, the team showed up at the Dayton Hamvention with logs and cards, handing out nearly 3000 cards that weekend.

During the same time period Jim Smith, VK9NS, was in Bhutan operating as A52JS, where he made some 20,000 contacts.

A German team traveled to Yemen and spent ten days operating heavily on most bands as 7O1YGF. Unfortunately, after ten days they were asked to cease operation. They had been verbally authorized to operate, but as of this writing have not been able to obtain written permisison. Thus, those thousands of 7O contacts are still "pending" as the team continues to try to obtain the required paperwork to validate their efforts.

The Dayton Hamvention proved to be a DXe'rs event this year. The A52A group handed out QSLs; Martti Laine passed out TXØDX cards; and Bernie, W3UR, had cards for his operation from East Timor. The FOØAAA team also had cards for the Clipperton DXpedition.

June: Things slowed down a bit in mid-year, but we saw operation from STØP in the Sudan. There has been very little operation from there recently, and the operation was welcomed by a lot of DXers. The operator was Jeff, G4KIB/5B4Y, and he was in the country until August.

The Kingman Reef/Palmyra DX Group announced plans for a major operation from Kingman Reef in October. As part of this effort, members of the group began shuttling in and out of Palmyra to assist the Conservation group preparing that island for use. One of those was Mike, KH6ND. Mike spent long periods of time on Palmyra handing out much-needed contacts. In the end, well over 25,000 contacts were

The WAZ Program

Single Band WAZ

80 Meter SSB

77 .....NT5C

10 Meter CW

158 .....WA1FCN

15 Meter CW

284 .....IK4MED

20 Meter RTTY

49.....G4BWP

160 Meters

160 .....N2QT (35 zones) 161 ....5B4ADA (38 zones)

All Band WAZ

SSB

4598 .....KQ3F
4599 .....HK6HKT
4600 .....IK7UFL
4601 .....IK7YZG
4602 .....IZ1ANU
4603 .....SM4TIY
4604 .....JF6WTY
4605 .....IK8OZP

Mixed

7983 .....VE2NW
7984 .....KQ3F
7985 .....ISØIGV
7986 .....JA1XEL
7987 .....DL2MIH

All CW

202 .....AF9H
203 .....K2IXQ
204 .....KQ3F
205 .....JA8NSF
206 .....DJ5CL
207 .....W5BPT
208 .....W8BP
209 .....PR7CPK

RTTY

123.....SV1RK

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CQ DX Honor Roll

The CQ DX Honor Roll recognizes those DXers who have submitted proof of confirmation with 275 or more ACTIVE countries. With few exceptions, the ARRL DXCC Countries List is used as the country standard. The CQ DX Award currently recognizes 333 countries. Honor Roll listing is automatic when an application is received and approved for 275 or more active countries. Deleted countries do not count and all totals are adjusted as deletions occur. To remain on the CQ DX Honor Roll, annual updates are required. All updates must be accompanied by an SASE if confirmation of total is required. The fee for endorsement sticker s is $1.00 each plus SASE. Please make checks payable to the awards manager, Billy F. Williams. All updates should be mailed to P.O. Box 9673, Jacksonville, FL 32208.

CW

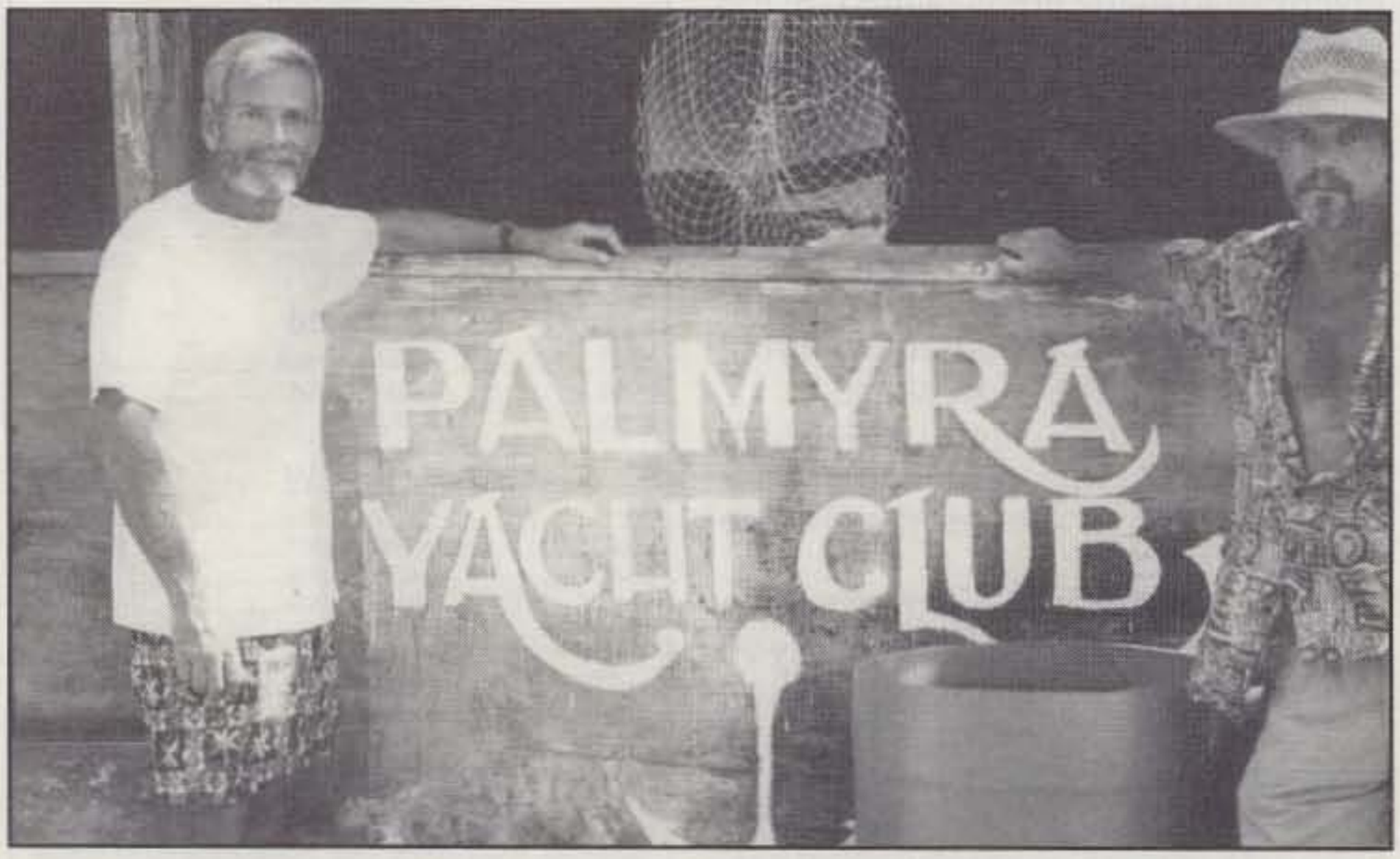
K2TQC 333	WA4IUM 331	W2UE 330	W4QB 327	4N7ZZ 326	WB4UBD 324	W4UW 319	CT1YH 313	KH6CF 300
K2FL 333	F3AT 331	F3TH 330	I1JQJ 327	VE7CNE 326	K8LJG 324	HA5NK 319	K9FYZ 313	K9HQW 299
K6JG 333	W2FXA 331	N7RO 330	N5FG 327	WA8DXA 325	I2EOW 324	SM5HV/HK7 317	K9DDO 312	KF8UN 299
K9BWQ 333	PT2TF 331	KZ4V 329	I4EAT 327	N5FW 325	N4AH 324	YU1AB 317	W3II 312	F6HMJ 296
K2ENT 333	W4OEL 331	K4CN 329	DL8CM 327	IK2ILH 325	LA7JO 324	G3KMQ 317	N4OT 311	WG7A 295
N7FU 333	K4CEB 331	W7CNL 329	SM6CST 327	9A2AA 325	NØFW 324	K7JS 317	WG5G/QRPp 307	W9IL 282
K3UA 333	K6GJ 331	K9IW 329	N4KG 327	OK1MP 325	W6SR 323	YU1TR 316	W7IIT 305	EA3BHK 282
K9MM 333	K2JF 331	WB5MTV 329	WØJLC 327	W4LI 325	9A2AJ 323	K8JJC 315	W6YQ 305	F5OIU 282
K2OWE 333	W6DN 330	IT9QDS 329	I4LCK 327	K3JGJ 325	KUØS 322	IKØADY 315	KE5PO 304	YC2OK 282
N4MM 331	G4BWP 330	K4IQJ 328	KA7T 327	K1HDO 325	HA5DA 321	OZ5UR 315	N7WO 303	XE1MD 278
K2JLA 332	EA2IA 330	W1WAI 328	N4CH 327	I5XIM 325	K6CU 321	K1FK 315	LU3DSI 302	EA2CIN 278
N4JF 331	W7OM 330	PAØXPQ 328	K7LAY 326	K5UO 325	N5HB 321	HB9DDZ 314	PY4WS 302	I3ZSX 276
K6LEB 331	WØHZ 330	DJ2PJ 328	NC9T 326	DL3DXX 324	VE7DX 320	N1HN 313	YU7FW 301	G3DPX 275
YU1HA 331	W8XD 330	K8PV 327	IT9TQH 326					

SSB

K4MZU 333	K4JLD 332	W6DN 330	4Z4DX 329	IT9TQH 327	IKØIOL 325	KØFP 320	K3LC 310	4X6DK 295
K2TQC 333	EA2IA 331	ZL3NS 330	VE7DX 329	IT9TGO 327	YV5AIP 325	N4CSF 320	WR5Y 310	YT1AT 294
K2FL 333	N4JF 331	XE1AE 330	K4CN 329	WD8MGQ 327	K9IW 325	N4HK 320	K7HG 309	OA4EI 292
W6EUF 333	VE1YX 331	VK4LC 330	I8KCI 329	I1EEW 327	WA4JTI 325	DL3DXX 320	EA3BHK 307	KØOZ 291
K2JLA 333	YU1AB 331	WB4UBD 330	ZL1AGO 329	SV1ADG 327	W8KS 325	AE5DX 320	WZ3E 306	EA5GMB 287
K6JG 333	W7OM 331	K3UA 330	N5FG 329	DL8CM 327	KC4MJ 325	KB1HC 320	N1ALR 306	YV5NWG 287
K6GJ 333	VE3MR 331	VE3MRS 330	W2JZK 328	KE4VU 327	K3JGJ 324	EA1JG 320	XE1MDX 305	KK4TR 286
K2ENT 333	KZ2P 331	WØYDB 330	YV1JV 328	I1JQJ 327	IØSGF 324	EA7TV 320	EA5OL 305	VE7HAM 285
K6YRA 333	K1UO 331	WA4IUM 330	KZ4V 328	F9RM 327	W2FKF 324	SV1RK 320	WB2AQC 305	F5RRS 284
K4MQG 333	W6BCQ 331	YV1KZ 330	WDØBNC 328	XE1MD 327	AC7DX 324	N6RJY 319	K6CF 304	CT1CFH 284
K7LAY 333	YV5IVB 331	YV1AJ 330	K1HDO 328	I4EAT 327	KØHQW 324	CT1EEN 319	KC4FW 304	WØIKD 283
IK1GPG 333	K7JS 331	I4LCK 330	VE4ACY 328	CT1EEB 327	ZL1BOQ 324	WA4DAN 319	EA5GMB 304	EA3CYM 283
K5OVC 333	DU9RG 331	4N7ZZ 330	K5UO 328	KF8UN 327	EA3BKI 323	EA3EQT 319	YC2OK 303	K7ZM 282
NØFW 333	VE3XN 331	YV1CLM 330	N5ZM 328	W2CC 327	I8KCI 323	CE1YI 318	WB2NQT 303	WN6J 281
OZ5EV 333	W4UNP 331	K8CSG 330	VE2PJ 328	W9OKL 327	K4JDJ 323	YV4VN 317	VK3IR 303	CP2DL 281
K9MM 333	PY4OY 331	W2FXA 330	PAØXPQ 328	W5RUK 327	W9IL 323	CT1AHU 316	W5GZI 302	F5JSK 281
ZL3NS 333	N7BK 331	XE1L 330	W6SHY 328	DL6KG 326	WW1N 322	N5HSF 316	N5QDE 302	YU1TR 280
N4MM 333	N7RO 331	W8ZET 330	K9PP 328	W6SR 326	F6BFI 322	K6RO 316	KD4YT 302	KK5UY 280
OZ3SK 333	I8LEL 331	VE7WJ 330	K9HQM 328	N4KG 326	LU7HJM 322	K7TCL 315	SV3AQR 302	EA3CWT 278
N4CH 333	OE3WWB 331	LA7JO 330	VE2GHZ 328	W4QB 326	K5NP 322	WB8ZRV 314	LU3HBO 301	N1KC 278
IØZV 333	IK8CNT 331	W9SS 330	WA4WTG 328	K8PV 326	NI5D 322	K9YY 313	YT7TY 300	9A9R 277
K5TVC 332	DL9OH 331	VE2WY 330	VE4ROY 328	KD8IW 326	PY2DBU 322	NØMI 313	K3LC 300	VE2DR 277
DJ9ZB 332	EA4DO 331	WS9V 329	AA6BB 327	W4LI 326	YZ7AA 321	KD5ZD 312	WA4ZZ 300	W6UPI 276
K9BWQ 332	K9FYZ 331	I2EOW 329	SM6CST 327	K6BZ 326	W8AXI 321	VE3CKP 311	LU5DV 300	KE4SCY 275
KØKG 332	PT2TF 331	K2JF 329	W3GG 327	W4WX 326	EA8TE 321	CT1YH 311	SV2CWY 300	VE2AJT 275
W4NKI 332	XE1VIC 331	W7FP 329	CX4HS 327	KE5PO 325	XE1CI 321	W5OXA 311	K6GFJ 299	Z31JA 275
W4UW 332	OE2EGL 331	WB3DNA 329	KX5V 327	N2VW 325	W6MFC 321	HA6NF 310	SV1RK 295	KA5OER 275
OE7SEL 332	W3AZD 331							

RTTY

K2ENT 331	W2JGR 316	NI4H 305	G4BWP 287	W4EEU 284	YC2OK 280	I2EOW 278	KE5PO 274	PAØXPQ 272
WB4UBD 320	K3UA 313	I1JQJ 289	EA5FKI 284	W4QB 280				



(Left to right) Tom, N4XP, and Mike, KH6ND, stopped at Palmyra Island as they returned from Kingman Reef. Mike, operating as KH6ND/KH5, made over 25,000 QSOs from Palmyra between June and October. He joined the Kingman Reef DXpedition Team, which made over 80,000 QSOs during their operation as K5K. QSL both operations via K4TSJ. (Photo courtesy Tom, N4XP)

directly attributable to Mike's efforts. Especially noteworthy were the 160 and 80 meter contacts he provided. His continuing efforts to improve his antennas for those bands proved invaluable, with large numbers of contacts around the world.

Louis Varney, G5RV, the originator of the world-famous "G5RV Antenna" passed away June 28, at the age of 89.

July: A small group headed by Rick, AI5P, and Duane, WV2B, had to go to extraordinary measures for their trip to St Paul (CY9). Previous operations from St. Paul were able to use the existing buildings for shelter. New requirements for access to the island included one which did not allow the use of those existing buildings and required the group to provide insurance. They had to obtain appropriate shelters (tents) and other items to effectively "camp out" while they were on the island. Eventually they were able to make the trip, although it was cut short due to deteri-

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"As I got older, my high frequency hearing loss was destroying my ham radio for me . . ."

-- Martin F. Jue, K5FLU
President and Founder
MFJ Enterprises, Inc.

I know I'm not the only ham who can't understand all the speech in a QSO caused by high frequency hearing loss. I developed a solution that I want to share with my fellow hams.

I almost gave up my ham radio hobby

I have been a passionate ham radio operator for over 40 years ever since I was a teenager. I loved every minute of it. Still do, but I almost had to give it up.

As I grew older (I'm 56 now) I found myself asking "*What did you say?*" so often it got downright embarrassing. I can hear pretty good most of the time. I just can't always understand what people are saying and my left ear is weaker than my right ear.

It got to where I was having trouble carrying on QSOs. I could hear, but I just couldn't quite make out all the words.

My hearing problem almost put a stop to my lifelong hobby.

There was no way I was going to give up ham radio . . .

Research showed me what to do

I searched the literature and spoke to hearing and speech experts.

According to their research on the intelligibility of speech in hearing English words:

1. The frequencies important for speech intelligibility are the consonant sounds from 500 to 4000 Hz. They contribute 83% of word intelligibility.

Frequencies from 500 to 1000 Hz contributes 35% of word intelligibility and 35% of sound energy.

Frequencies from 1000 to 4000 Hz contributes *48% of intelligibility* but has *only 4% of sound energy!*

2. In contrast, frequencies from 125 to 500 Hz contributes 55% of sound energy but only 4% to word intelligibility.

***In** other words, nearly half the speech intelligibility is contained in 1000 to 4000 Hz frequency range with only 4% of the speech sound energy.*

On the other hand, the low frequencies 125 to 500 Hz have most of the speech energy but contribute very little to intelligibility.

How I improved my ability to hear and understand QSOs

The research showed me what to do.

First, drastically increase the speech energy above 500 Hz where 83% of intelligibility is concentrated.

Second, drastically reduce the speech energy below 500 Hz that contributes only 4% of intelligibility.

Amateur radio communications limit audio to about 300 to 2700 Hz.

I split the audio band into four overlapping octave ranges centered at 300, 600, 1200, 2400 Hz.

I could boost or cut each range by nearly 20 db to give me full control. This let me maximize speech intelligibility for most kinds of frequency loss.

My left ear is weaker than my right ear so I split the output audio into left and right channels with separate 2½ watt amplifiers. A balance control lets me equalize the perceived loudness to each ear. *Now both ears help in improving speech intelligibility!*

I couldn't believe my ears!

I built one and hooked it to my rig.

I boosted the high frequencies, cut the low frequencies, set the volume and adjusted the balanced control so I could hear each side equally loud.

***I** couldn't believe my ears! Speech that I could hear but barely understand before was now highly understandable. I got my ham radio back!*

With this concept, you'll *understand* QSOs better and enjoy ragchewing and contesting more, even if you don't have high frequency hearing loss.

It helped me so much I wanted to share this with my fellow hams

I developed this into an accessory that any ham can use.

I made it immune to RFI, added a front panel phone jack, on/off speaker switch, two selectable transceiver inputs, a bypass switch for in/out comparison and built it into 10Wx2½Hx6D inch aluminum enclosure. Needs 12 VDC.

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QSL INFORMATION

1AØKM to IKØFVC
1X5AA to W3HNK
3A/OH4GN to N4GN
3A/OH9MM to OH3LQK
3A2DX pirate
3B8CO to F4AUT
3B8MM to DL6UAA
3D2AU to Z32AU
3D2CQ to N6PEQ
3DAØNL to ZS6ANL
3V8BT to I5JHW
3V8CB to DL1BDF
3W2EZD to XW2A
3W2LC to VK6LC
3W2LWS to WA1LWS
3W2US to N2OO
4K2BDU to UA9MA
4LØDXP to K1WY
4L1BR to KE1HZ
4L4KL to DL8KAC
4S7OF to KØJN
4W/K7BV to KU9C
4W/OH2BF to OH2IC
4W/ON6TT to ON5NT
4W6BCN to VK3BCN
4X/JM1LJS to JL2XUN
4X1KS to N2AU
4X6A to 4Z4DX
4X6UO to WB3CQN
5B4/UN2O to IK2QPR
5H3US to WA8JOC
5K9AQ to HJ3PXA
5R8GR to DK6ST
5R8GS to DL1DA
5WØCT to G3YBO
5WØSF to OE2SNL
6W/DK8YY to DH7WW
7A32AR to YBØFMT
7Q7HB to GØIAS
7Q7PA to N5PA
8P9JM to K2ZD
8P9JR to PA5ET
8P9JS to PA5ET
8Q7JL to JL6MSN
8Q7JY to JJ1LIB
8Q7NSR to I5NSR
8Q7QQ to HB9QQ
8Q7SR to I5NSR
8R27CC to 8R1WD
9AØA to OK1FLM
9AØDX to 9A3ZA
9A1ØC to 9A7K
9A9ØØZ to 9A2DM
9G5AP to UA3AP
9G5MG to G3OCA
9HØVRZ to PAØJR
9MØF to JA1HGY
3B8GO to Piero Provust, BP 78, Curepipe, Mauritius
3D2AD – Sept, 2000 via YT1AD, Hranislav Milosevic, Lenjinov Bulevar 10-E 254, 11070, Novi Beograd, Yugoslavia
4S7VK – North America via NZ9Z; rest of the world via DJ9ZB, Franz Langner, Benfelder Str. 4, D-77955 Ettenheim, Germany
4U1VIC to Vienna International Centre, PO Box 200, A-1400 Vienna, Austria
4Z4DX to Dov Gavish, 27 Hamitnahalim, Ramat Hasharon, Israel
5B4KH to George Mappouras, PO Box 27638, Engomi, 2432, Nicosia, Cyprus
5H5A to Box 167, Iringa, Tanzania
6MØMM to Sweng Woong Woo, Korea Institute of Nuclear Safety, PO Box 114, Yousung, Daejeon, Korea 305-338
7J1ABD to Daniel J Domondon, 3-18-9 Kami-Igusa, Suginami, Tokyo 167, Japan
8A3B to PO Box 4025, Surabaya 60401, Indonesia
8J2ØØØ to JARL QSL Bureau, 1324-3 Kanba, Hikawa, Shimane 699-0588, Japan
8Q7XX – Aug 31 - Sept 11, 2000 via EA4DX, Roberto Diaz Gonzalez, Doce de Octubre 4, 28009 Madrid, Spain
9A5KV to Alfred Raguz, PO Box 286, 20000 Dubrovnik, Croatia
9J2RA – July 13/31, 2000 only via K6SLO
9V1WW to James Basil Rodrigo, 13 Ghim Moh Rd 19-37, Singapore 270013, Singapore
A71MA to Shk Mohd Bin Abdul Aziz Al-Thani, PO Box 24545, Doha, Qatar
A92GE to David Smith, PO Box 1976, Manama, Bahrain
AAØDX to Gregg M. Mihelich, 12445 Townline Rd, Hibbing, MN 55746 USA
AC4G to Bruce A. Smith, 1056 Old Railroad Bed Rd, Taft, TN 38488 USA
AH8LG to Lawrence A. Gandy, PO Box 1618, Pago Pago, AS 96799 USA
AL7O to Gary L. McCrorey, 66990 North Fork Rd, Anchor Point, AK 99556-9258, USA
AP2HA to Hasnat Ahmed Bugvi, POB 2410, Islamabad 44000, Pakistan
BA4DC to Ralph Chian, 573 Fu-Xing-Zhong Lu, Shanghai 200025, China
BV4AS to Jimmy Tu, PO Box 553, Taichung, TA, 400, PR of China
C31BO to Archie Layno, PO Box 2044, Andorra La Vella, Andorra
C91AH to Remo M Padre Bernardo, Box 3601, Maputo, Mozambique
CO1OTA to Grupo DX Cuba, Apdo.1, Habana 10100, Cuba
CQ9K to PO Box 19, 9001-901 Funchal, Madeira Isl.
CQ9S to PO Box 19, 9001-901 Funchal, Madeira Isl.
CT1AOZ to Jose M.S. Albuquerque, Rua Sta Clara 269 - 3D., Qta.S.Miguel das Encostas, 2775-737 Carcavelos, Portugal
CT1CBI to Antonio M D Sousa, Rua Brasil N-6, B Dominguinhos, P-2520 Peniche, Portugal
CT1DVV to Antonio Santos, PO Box 5Ø37, 3000 Coimbra, Portugal
CT1RVM/P to ARVM Assuncao Rad V Moscavide, Rua Antonio Maria Pais 6, 4-E, Moscavide, P-1885 Lisboa, Portugal
CT4MS to Leonel F C Soares, Rua Luis de Camoes 15-1, P-2900-446 Setubal, Portugal
D44BS to Angelo Mendes, PO Box 308, Praia, Cape Verde Is, via Portugal
D68IB to Idris Badat, PO Box 148, F 97463 St-Denis cx, Reunion Island
DH7WW to Ulrich Moeckel, Muldenstr. 1, D-08304 Schoenheide, Germany
DJ4LH to Henrik Hansen, Hauptstr. 3, 25885 Immenstedt, Germany
DJ4SO to Klaus Behrndt, Bosseer Str. 8, D-24259 Westensee, Germany
DJ5AV to Michael Oerter, Birkenweg 19, D-88633 Heiligenberg, Germany
DL1BDF to Mustapha Landoulsi, Westlinteler Weg 30, Norden, D-26506, Germany
DL7DF to Sigi Presch, Wilhelmsmuehlenweg 123, D-12621 Berlin, Germany
DL8KAC to Vlad Engel, Stuadter Weg 51AD.51766 Engelskirchen BRD, Germany
E3ØLA – August 2000 via W7LN
E3ØMA – August 2000 via W7LN
EA3AJW to Jaime Vallvey Reyes, PO Box 15045, 08018 Barcelona, Spain
EA4URE to URE Headquarters, PO Box 220, Madrid, 28080, Spain
EA5ZI to Jose Juan Alberca Palop, Apartado Postal 326 (Mayans 9 - 1) 46870 Onteniente, Valencia, Spain
EA7ADH to Francisco de la Serna, Cristobal Colon, 28A41710 Utrera - Sevilla, Spain
EA8PP to PO Box 95, La Laguna 38200, Tenerife, Canary Islands, Spain
ED3IM – IOTA contest 2000 via ON7LX, Carine Ramon, Bruggesteenweg 77B-8755 Ruiselede, Belgium
ED3IM – July 22/23, 2000 via EA3CKX, Santiago Sanye Gonzalez Rosello, 25-1 Barrio Bellavista 08520Ø Les Franqueses Del Valles Barcelona, Spain
EI9HQ to Declan Lennon, 45 Pearse Park, SallynogginDun Laoghaire, Co. Dublin, Ireland
EK8WB to Box 50, Gyumri, Armenia
EM1U to current manager via UT7UA, PO Box 88, Kiev-Ukraine, 252191, Ukraine
EP1DX – year 2000 contacts are pirate
EP2FM – registered mail to Abdollah Sadjadian, PO Box 16765-1187, Tehran, Iran
ER5AA to Vasily, PO Box 10, MD3903, Cahul-3, Moldova
ET3DP – for USA via Dennis Panther, Dept. of State, 2030 Addis Ababa Pl., Washington, DC 20521 USA
EW5HQ to PO Box 469, Minsk 220050, Belarus
EX8MLE to Sergey Tkachenko, PO Box 742, Bishkek, 720017,Rep of Kyrgyzstan
EZ7AT to Ikhtiyar Ovliyakulyev, PO Box 45, Turkmenabat-21, 746121, Turkmenistan

(The table of QSL Managers is courtesy of John Shelton, K1XN, editor of "The Go List," PO Box 3071, Paris, TN 38242; phone 901-641-0109; e-mail : <golist@wk.net>.)

orating weather conditions forcing them off the island.

A short operation by an Italian group from 1AØKM provided a lot of contacts with this semi-rare entity.

Lew McCoy, W1ICP, became a Silent Key on July 31, at the age of 84. Lew was an ARRL staff member for many years, *CQ*'s Technical Representative, and a past president of QCWA.

August: Tromelin (FR/F6KDFT) was activated by the Lyon DX Group and provided much-needed QS's for about ten days. Tromelin had been high on the Most Wanted lists for a long time, especially on CW, and this group did an excellent job of providing contacts on all bands and modes. They ended up with over 50,000 contacts.

PYØS, St Peter & St Paul, finally got some activity in late August, but it was timed in hours, not days, of operation. At the mercy of the Brazilian Navy, the operators were only able to operate for short periods of time over the less than two days they were on the island.

September: The Clipperton DX Club was in Bhutan (A5) for a few weeks in early September.

Bob, G3ZEM/ZD9ZM, was active from Tristan da Cunha for over two weeks, mostly on CW, but also other modes.

Mid-September brought the W9 DXCC Convention in Chicago. This well-attended affair brought together DXers from all over the USA and Canada, as well as some from outside North America.

Andy, G4ZVJ, showed up from 5V7VJ, making over 15,000 QSOs, including over 1000 on 80 meters. He followed that up with a short stay in Accra, Ghana as 9G5VJ, making over 1100 contacts from there.

October: Dennis, K7BV, and Dick,

CQ DX Awards Program

SSB

2317	UA9LM	2320	KA5AGM
2318	IZ1ANU	2321	IK1PFE
2319	K3MI		

RTTY

32	SV1RK

SSB Endorsements

320	K4MZU/333	320	K9BWQ/332
320	K2TQC/333	320	KØKG/332
320	K2FL/333	320	W4NKI/332
320	W6EUF/333	320	W4UW/332
320	K2JLA/333	320	OE7SEL/332
320	K6JG/333	320	K4JLD/332
320	K6GJ/333	320	K3UA/332
320	K2ENT/333	320	OE2EGL/331
320	K6YRA/333	320	W3AZD/331
320	K4MQG/333	320	K2JF/330
320	K7LAY/333	320	VE2WY/330
320	IK1GPG/333	320	VE4ROY/328
320	K5OVC/333	320	WA4WTG/328
320	NØFW/333	320	W2FGY/326
320	OZ5EV/333	320	W4WX/326
320	K9MM/333	320	ZL1BOQ/324
320	ZL3NS/333	320	SV1RK/320
320	N4MM/333	310	LU3HBO/310
320	OZ3SK/333	200	JR4NUN/239
320	N4CH/333	200	K3BSA/230
320	IØZV/333	150	IK1PFE/190
320	K5TVC/332	150	KA5AGM/176
320	DJ9ZB/332		

CW Endorsements

320	K2TQC/333	320	K4CEB/331
320	K2FL/333	320	K2JF/331
320	K6JG/333	320	K6GJ/331
320	K9BWQ/333	320	N4CH/327
320	K2ENT/333	320	K7LAY/326
320	N7FU/333	320	NØFW/324
320	K3UA/333	320	K4JLD/321
320	K9MM/333	310	W4UW/319
320	K2OWE/333	300	N7WO/303
320	N4MM/333	200	GI4SNC/201
320	K2JLA/332	200	K6UXO/201

RTTY Endorsements

320	K2ENT/331	310	K3UA/315

The basic award fee for subscribers to *CQ* is $6. For non-subscribers, it is $12. In order to qualify for the reduced subscriber rate, please enclose your latest *CQ* mailing label with your application. Endorsement stickers are $1.00 each plus SASE. Updates not involving the issuance of a sticker are free. Rules and application forms for the CQ DX Awards Program may be obtained by sending a business-size, No. 10, self-addressed, stamped envelope to CQ DX Awards Manager, Billy Williams, N4UF, Box 9673, Jacksonville, FL 32208 U.S.A. Currently we recognize 331 active countries. Please make all checks payable to the award manager.

N6FF, operated from East Timor, providing thousands of low-band contacts. With over 13,000 QSOs and 5400 on the low bands, they made a lot of DXers happy during their stay in this dangerous location.

The much-anticipated Kingman Reef operation got off to a rough start with heavy winds and rain keeping the team virtually pinned down under tarps for three days. The weather finally moderated enough for them to get antennas, radios, and generators up and running. The surprise callsign K5K made it easy to find them, along with their outstanding signals on all bands. At this writing the totals are not complete, but it appears that the KRPDXG had over 80,000 QSOs, making it one of the largest, in terms of total contacts.

Zhu, BDØAR, at the controls of club station BYØAA. (Photo via K3ZO)

Yet another operation from Bhutan, this time by a Japanese group the end of October, early November provided another opportunity for DXers to put this former Most Wanted in their log.

DL5NAM and DF4RD spent some time in Eritrea as E30TA, working about 25,000 QSO's before closing down on October 31.

Still to come in November and December are scheduled operations from HV (Vatican), 5T (Mauritania) and SØ (Western Sahara), ZK2 (Niue), A5 (Bhutan), and others.

Already planned for 2001 are operations from 3D2/C (Conway Reef) by two different groups, one in February and the second in April. Also in February, an operation from CEØX (San Felix) is in the works.

The year 2000 was certainly "one for the books" with so many Most Wanted entities being activated. Could 2001 even come close? Well, only time will tell who goes where, when, and for how long. There are strong rumors of an operation from the Most Wanted of all —P5, *North Korea*—for early January.

Good luck to all of you in 2001!

73, Carl, N4AA

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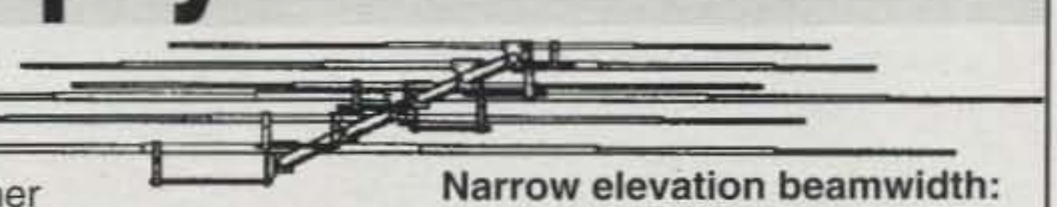

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Public Service

BY BOB JOSUWEIT, WA3PZO

Public Service and Emergency Communications

Challenges for the New Year

Last year at this time we were deeply involved with various Y2K scenarios. Was the elaborate communications infrastructure on which we have become so dependent going to survive the date change to the year 2000?

As we all know, New Year's Eve was an event we were prepared to assist with, but one which required little action after the clock actually struck midnight.

Do we have challenges this year? Absolutely! They might not be documented or talked about as much as Y2K, but they need to be addressed.

FCC Authorizes New Radio Services

Last year the FCC authorized two new radio services. One is a new Citizens Band Radio Service called the Multi-Use Radio Service, or MURS. The other is the Family Radio Service, or FRS.

The FCC created the Family Radio Service (FRS) as an unlicensed service for use by families and groups. FRS radios, which operate on UHF frequencies, are readily available at popular consumer stores for $45 to $100. They are pocket-size and use common AA batteries. While advertising claims up to two miles in range, they seem reliable for one-half to three-quarters of a mile under typical city conditions.

MURS will use five channels in the 151–155 MHz range and will be authorized for up to 2 watts on an unlicensed basis under Part 95 of the FCC's rules. FRS is for short-range communications. Besides voice transmissions, telemetry and radio-control transmissions, which may operate with a continuous carrier on four of the five frequencies, are permitted. MURS will be able to be used for phone patches, packet, paging, images, telemetry, and remote control. External antennas are also permitted with no height restrictions.

MURS has the potential of providing many of the same services that amateur radio operators have provided for years—clear voice communications, extended range via repeaters, auto-patch, and digital operations. Is the death of ham radio public service near? Not by a long shot, but there are things that can be done to show the benefits of ham radio to the public.

c/o CQ magazine
e-mail: <wa3pzo@cq-amateur-radio.com>

Training is the Key!

The FCC rules regarding the Amateur Radio Service indicate that communications during times of emergency is one of our basic purposes. Few knowledgeable amateurs would argue that such communications are in our best interests when official support for the hobby is needed.

"Those alone are two good reasons why amateurs should prepare in advance to provide the various types of communications support which may be needed depending upon the nature of the emergency or disaster," says Jerry Boyd, K6BZ, ARRL Section Manager in the Sacramento Valley. Boyd, a retired Chief of Police, and a past member and chairman of the ARRL's Emergency Communication Advisory Committee, suggests a third and even more compelling reason for advanced preparation.

Boyd continues, "In California there is a bill pending before the legislature (and if such a bill passes in California other states will likely follow the lead) which will *require* volunteers who are affiliated with public agencies for service in times of emergency to demonstrate that they meet certain training requirements. Further, there will be a continuing, annual requirement for such training. Reserve police officers and volunteer firefighters have long had to meet such requirements. In the very near future because of this pending legislation which is prompted by government's concern for "vicarious liability," amateur radio operators may need to do the same *or* their services will no longer be called upon. If that occurs, our 'official' support when efforts are made to grab our frequencies or further restrict our antenna structures will vanish."

Boyd suggests that the ARRL's new Continuing Education Program, the first segment of which pertains to emergency communications, may qualify for the training California law envisions. He also suggests that amateurs complete various FEMA home study classes and

W9WZE HAPPY HALLI-WEEN PARTICIPATION AWARD

Presented By Halligan's Hallicrafters

This enchanted scroll certifies that Brandon Carpenter did materialize from the foggy ethers of Halloween on Sunday October 29, 2000 on a blood curdling frequency of 7.280 (*) 14.293 ( ) Mhz. The ghosts of time marked the worldly passing at (1822) UTC.

The full Moon glowed while the Pumkin rolled and the Witch with wart of nose told of things that glow in the night. The horseman with head chased goblins of dread and ancient vampires that fled as pale moonlight flickered and died. The werewolf did howl and startled an Owl as skeletons rattled by. The candle flame fluttered as carmel corn sputtered and somewhere someone cried. Kids clutching candy so sweet as dry leaves rustled by feet and voices whailed trick or treat. Now comes the dawn and Halloween is gone, but Hallicrafters lives on forever.

Net Control: Duane Fischer W8DBF
Trustee: W9WZE (William Halligan Sr., founder of Hallicrafters)
ArtWork: Brian Hill & Shelly Carpenter

The Halligan Hallicrafters group invited kids to the shack during Halloween. (Photo via Duane Fischer, W8DBF)

retain the certificates of completion for later presentation to the government agencies which your ARES/RACES/ACS unit serves. Boyd feels, "It may take a few years to implement nationwide, but as one who follows government-amateur partnerships closely, I am convinced the day will come when we will need to prove our training in order to be allowed to serve."

Looking Beyond the "-thon"

In 1999 in southeastern Michigan, the "Stu Rock" Radio Club formed an Emergency Communications Response Team to support four community public safety agencies' communication efforts. Bill Pomeroy, WD8ODW, says, "Our emergency communications response team was formed to provide community service, a commitment that many of us feel is a requisite for being licensed ham radio operators, and we viewed this event as an opportunity to practice our response skills."

During four days in September, approximately 10,000 individuals attended a Eucharistic Congress in Plymouth Township. The Stu Rockafellow Amateur Radio Society ("Stu Rock") club was asked to staff a command center to coordinate communications between various police, fire, and other safety agencies whose radio systems are incompatible. Since individuals attending the meeting were required to park several miles off-site and be shuttled to the meeting location via chartered busses, club members also patrolled the outlying parking areas to provide emergency communication services and monitor traffic conditions for various police agecies. These remote parking lots involved the communities that the Stu Rock club serves.

CQ asked Bill to describe the club's working relationship with the communities. "Following meetings with the four police chiefs, all of whom are very forward-thinking individuals, we were issued identity cards signed by all four police chiefs, alerting police officers that when activated by officials of any of the four communities, we should be recognized as communications support volunteers on those occasions. Within our program we have a cascading notification system that permits a police official to place only one telephone call, and our team captains notify other radio operators." The club's repeater is on 222 MHz with a link to 2 meters.

He continues, "We have provided communications services during summer dismissal at our local high schools to alert police if their services are required, we staffed several police stations during the Y2K transition, our members circulate through church and school sites in four communities on Devils Night and Halloween, we established a site for the July 4th community celebration, and we are all trained weather spotters who position ourselves at assigned locations when activated. We use large magnetic automobile door signs to identify ourselves when we are involved in community communications support, a very important adjunct regarding police and citizen recognition.

"Our club's community coordinators participated in several planning meetings with public safety people and others well in advance of the program. I estimate that we probably spent over 12 hours in planning sessions. We staffed the command center from early morning until evening September 14–17.

"Although we did not volunteer our services with the objective of receiving

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Members of the Stu Rock Amateur Radio Society staff the command post for a four-day Eucharistic Congress. Left to right: Max Behrens, W3DBY; Ralph Moote, K8DPL; and Bill Pomeroy, WD8ODW. (Photo via Bill Pomeroy, WD8ODW)

praise or recognition, the 'top guy' at the event, Cardinal Adam Maida, Archbishop of the Detroit Diocese, made it a point to come to our command center to thank us for our efforts. This was particularly gratifying since many of our club volunteers are not Catholic."

Other Events and Planning

Looking for suggestions on non-traditional events to help out with, the Reading (Pennsylvania) Radio Club has been helping with a "Strike Up the Band" high school marching competition for over 21 years. In Georgia hams are helping out with a dog show. The opportunities are there.

Now is the time to look at how your group approaches an event. Don't wait until the week before the event just to make sure everything is in place the way it has been every other year. In an internet posting, Ray Vaughan, KD4BBM, asked groups to evaluate the work that they are doing. "Are you really making a difference?" he asks. "If you weren't there, would anyone really notice?"

Some groups would say, "We've done it this way for years and it works."

Why change it? Do you welcome new technologies such as APRS? In some cases, the people you traditionally shadowed are now carrying radios and communicating themselves.

Become involved with the event planning. If you have been on the fringe or in the middle of the chaos and confusion of some events, now is the time to put your experience to work as a trained communicator and a technology expert.

As Vaughan puts it, "You are now the player, making decisions, taking input and acting on it. You are using amateur radio, but it isn't your primary role. You aren't the screwdriver; you're the engine. The feeling after the event is totally different. It really wouldn't have been the same event without you."

By making a suggestion, you might have a better idea and possibly allow the organizers to put more money towards the charity rather than the event itself.

Before the event takes place, get to know what other radio systems are involved and see if you can become familiar with them. This could be a local trunked radio system or one of the new radio services. As Vaughan suggests, ham radio is just a tool in our tool box.

"Next event, tape the net frequency," says Vaughan. "A few weeks later, listen to it and look for common themes. If you hear 'Where is the ICE truck?" twenty times, then next year put an APRS tracker on it. If the organizers say that they don't know how many riders are on the sag wagon, come up with a way to use packet to send the bikers' numbers to net control. A printer at the Command Post gives the organizers what they need. In general, keep an open mind and be willing to say that things should change. You have to be involved in the event planning to get to this level. However, when they see what you're offering, you'll be invited back."

As other radio services become established, hams will have to continue to show their value as a service in the public interest.

Get Kids Involved....

This year there will be a push to get kids involved with amateur radio. As we have mentioned in previous columns, providing educational opportunities is a form of public service. As various community events come up, keep an eye open for ways of introducing kids to amateur radio.

One of the biggest events geared to children is Halloween. The Halligan Hallicrafters group sponsored a Halloween Kid's Day. The group hosted a weekend

"Stu Rock" members Dave Barker, W8QGE, and his son Jordan, KC8NKX, patrol the grounds in clearly identified vehicles. (Photo via WD8ODW)

of fun for children ages 17 and under. Operating special event station W9WZE, kids making contact were eligible to receive an 8×10 color certificate.

The afternoon event was hosted by Magician/Illusionist Duane Fischer, W8DBF, of Flint, Michigan. Fisher says, "The purpose is to get youngsters excited about amateur radio. The hope is to interest them enough to motivate them to get a license and join with us."

Fisher encouraged hams to "invite all the youngsters you can crowd into the old ham shack!" As Fisher sees it, "Our future depends on the seeds we plant today. If we never plant the garden, there will be no harvest of future hams."

As part of the group's promotional material, Fisher said, "If you love amateur radio, as I do, then get off your tomb stone and give those old skeletal bones a shake. You don't have to wake up the dearly departed, but your children would be helpful! Put down your pitchfork, wipe the pumpkin pie off your fangs, and herd those little ghosts, goblins, and ghouls into that room where the radio does glow in the dark. Park your broom stick, get off your drum stick, and warm up that yonder vertical stick."

Amateur radio operators can provide important communications for non-traditional events such as a church activity. (Photo via WD8ODW)

Disasters Don't Wait

Hams around the world continue to provide emergency communications following local disasters.

In Arizona amateur radio operators provided much-needed communications after five inches of rain fell on parts of the southwestern United States. David C. McCarthy, KC7AYX, Communications Officer for the American Red Cross, said in the first three days of the disaster from 20 to 25 hams assisted with communications. They provided vital links between the Red Cross headquarters and shelter in Parker, Arizona; the Red Cross Central Arizona Chapter Communications Center in Phoenix; and field units conducting damage assessment, providing food, and doing bulk distribution in the flooded areas in and around the town of Wenden. This is covering a distance of 175 miles east to west.

According to McCarthy, the need for amateur radio communications became critical because there is limited cell-phone coverage and very few pay phones. Besides using repeaters provided by the Arizona Repeater Association, APRS was used to track some of the units in the field through digipeaters provided by the Motorola Amateur Radio Club of Arizona.

Around the world many agencies have responded to disasters rather than being proactive to mitigate destruction. In recent years in the US the Federal Emergency Management Agency has been proactive in disaster preparedness.

In India there is discussion between traditionalists of "crying wolf" before a possible disaster hits, and those who are being proactive and issuing warnings prior to severe weather striking. Recently, authorities took a lashing for their response to a cyclone, which died out over the Bay of Bengal.

Some agencies have begun taking pre-emptive action. In the town of Ersama, ActionAid set up five ham radio stations so that local communities can exchange information on the weather and give advice to villagers. Along the Bay of Bombay, where thousands of residents are killed each year by cyclones, village communities are also being encouraged to set up contingency plans and carry out mock drills.

What are Your Plans?

We have presented some of the challenges facing us in ham radio public service this year. Do you have others? How is your group serving in the public interest? Your information helps to shape this column. Drop me a note about your public-service activity. We look forward to hearing from you. Until next time...

73, Bob, WA3PZO

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Math's Notes

What's New And How To Use It

BY IRWIN MATH, WA2NDM

Food for Thought

First, as always, a very happy and healthy New Year to all readers of this column and especially to those who have been able to bear with me for more than the past quarter century. I sincerely thank you for your continued support and hope to share the many exciting new developments (as well as my thoughts) that will most certainly occur as time marches on.

I find it hard to believe that we are now in the year that the science fiction stories I read as a youngster called "the distant future." As I indicated last month, although we cannot really predict where our technology will take us in the months and years to come, rest assured it truly will be amazing. It is my hope, however, that the experimenter and "inventor" portion of the amateur radio fraternity can continue to make the same sort of technical contributions that were made in the early part of the 20th century.

Although today at first glance it may seem an almost impossible task to develop anything technologically significant without a high degree of expertise in solid-state physics, consider what was known compared to what was developed in the early 1900s. The analogy is really the same, since those future developments were just as "impossible" to predict at that point in time. In fact, our modern technological base is infinitely more broad than the oatmeal-box coil forms, cat's whiskers, and Model T spark coils of the 1900s, so in theory, at least, an individual should be able to develop (or "invent") much more sophisticated devices. Remember, the human mind has not yet been replaced with artificial intelligence, and a whole plethora of components that could not even be imagined in 1900 are routinely available. All of the necessary "ingredients" are there. It is up to us to take advantage of this. It's fun to dream about the role we might have in the future, though, so let's take a moment and try to identify some possible starting points.

Artificial intelligence has brought us to the point where a computerized operator answers most of our telephone directory assistance questions using both voice recognition and synthesis techniques. You can even buy a software package that lets you dictate letters in many of the popular word processor formats, as well as have written documents read back to you. Does this mean that with a little bit of additional processing we will be able to have "intelligent" conversations with our machines? Will the computers of the science-fiction movies become reality in the next few years? Watch out! It could, and I believe it will, happen! For the experimenters in our midst it's really all only clever software. You probably have the computing power and the microphone/speaker I/Os in your possession already. I don't really think you need the equivalent of a Bell Labs to make a significant contribution. It would be interesting to come home and ask the computer, "What's on 20 meters?" (and get an accurate verbal answer to boot), wouldn't it?

Cellular telephone technology has shown us just how reliably an 800–900 MHz line-of-sight, full-duplex HT can operate. Can amateurs develop similar computer/RF links that can evolve into the next generation of "intelligent" repeaters? Will you someday be able to either simply speak someone's call or call "CQ {some country}" into a microphone and be connected directly to them or at least to a group within the selected country no matter where on the Earth that might be? Also, do other frequencies, including those readily available to amateurs, exist that can achieve similar (or even better) results than in the 800 MHz area?

Less than 100 years ago anything above 1–2 MHz was considered a wasteland. Today the spectrum from 100 GHz to light (and then beyond) is virtually unknown, so there is plenty of virgin territory for experimentation. How does one operate at 250, 500, or 1000 GHz? The amateurs of the past didn't ask how to push the technology into the "short waves"; they just experimented and eventually figured out how to do it. Sometimes the fact that they did not have an extensive technical education (that "proved" that something such as short waves were useless) was actually a blessing.

c/o CQ magazine

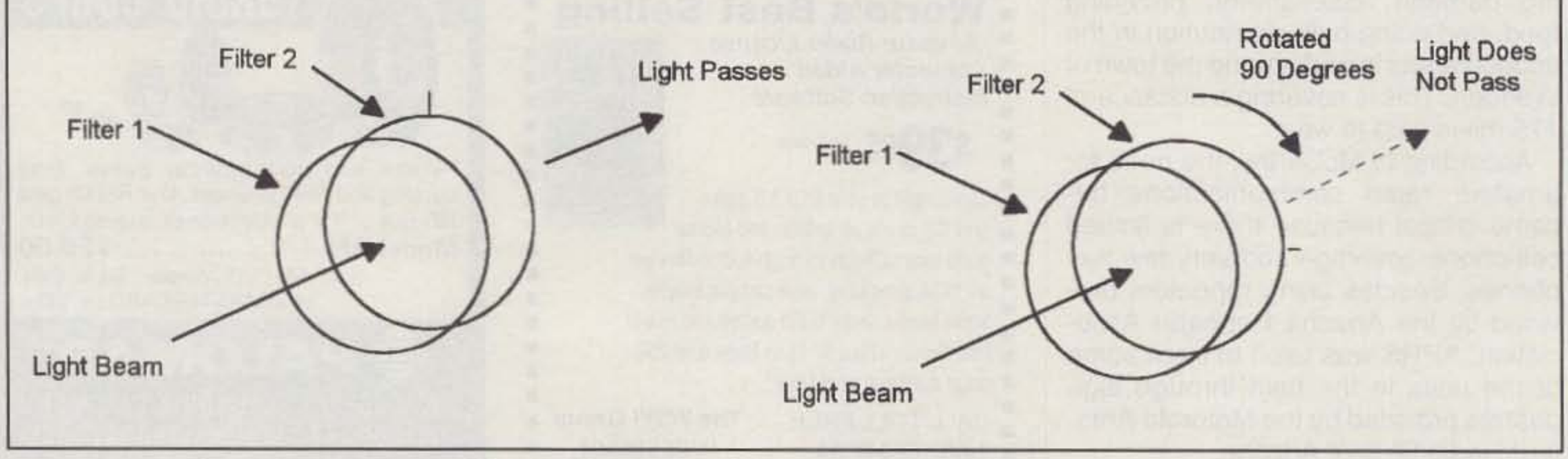

Fig. 1– The use of polarizers as a light modulator.

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Try something. You might be surprised! And don't be afraid of the ultra-low frequencies either. The military has been communicating with submarines under the ocean, on the opposite side of the Earth, at frequencies well below 200 kHz for years.

In the same light (forgive the pun), how about optical communications? Consider the advantages of very narrow beamwidths (less than a fraction of a degree). You could make an optical beam antenna with a front-to-back ratio of better than 100 dB using mirrors, or reflections, or who knows what! Sure, the laser diodes that might be used for optical transmitters today can only put out milliwatts, but why limit yourself to a laser when you can get a 1000 watt projector lamp, connect your newly designed external optical modulator that works directly on the beam from the lamp (well, you have to do something clever), connect your lens- or mirror-based optical "antenna," and come up with an optical kilowatt? Why not? Perhaps you can start a new chapter in what amateur radio (or should we rename it "Amateur Wireless") communications will become.

Then there is the whole world of modulation techniques. We now know of and routinely use AM, FM, SSB, spread spectrum, and a wide range of digital-pulse rate/width/position encoding methods of all kinds. What else is lurking around the corner? At a recent trade show we saw a start-up company transmitting signals by some sort of pulse method using modulated harmonics of a single frequency. They claimed long range with high peak power but very little average power. Their pulse method also assured a high degree of immunity to interference. Possibly you may find the next mode. Remember, when AM was king, E. H. Armstrong (in a lab that was a joke compared to what exists today in even a modest experimenter's shack) developed FM! The list goes on.

You should notice that all of the above does not really require any large-scale expenditure in exotic equipment. It does, however, require a significant investment in brain power.

If you are fortunate enough to have a modest budget, the possibilities extend even further. By way of example, Thomas Edison was able to manufacture light bulbs with the type of vacuum pump that could be found in any high school physics lab today and could easily have made simple vacuum tubes well before Lee De Forrest if he only realized what they would be capable of.

While you might have a hard time making transistors or integrated circuits in your shack, galena crystals, which were our first elementary semiconductors, made pretty good detectors of low-frequency RF at the dawn of radio. Do similar devices exist today to detect "whatever"? I'll bet that in the year 2100 there will be many who will look back and say, "Gee, why didn't I think of that?"

If you read about the work of Heinrich Hertz in turn-of-the-century scientific journals, you will see that he actually generated and demonstrated many of the characteristics of 150 MHz VHF RF before the word *radio* was even coined, and that was using a spark coil plus some well-machined mechanical components! There were no synthesizers, MOSFETs, diplexers, or for that matter anything at that time that even looked like an RF component at any frequency. Remember when we spoke about generating microwave signals with a doorbell buzzer and a surplus cavity in a column last year? Very elementary it is true, but it worked. Could you generate and detect crude "futuristic signals" by some similar technique? I'll bet you can!

I have a lot of faith in human ingenuity. I also believe that the basis of most, if not all, future technology exists today and that it is well within the capabilities of the technically-inclined individual to play a significant role in the development of some of that technology. It is really only your state of mind. To paraphrase an old Chinese proverb, "If you want to develop something badly enough, be careful. You may find that you can!"

If you want the entire amateur radio experience to continue into the 21st century, you might find that you have to convince the FCC and the powers that be that there is a valid reason why it should.

73, Irwin, WA2NDM

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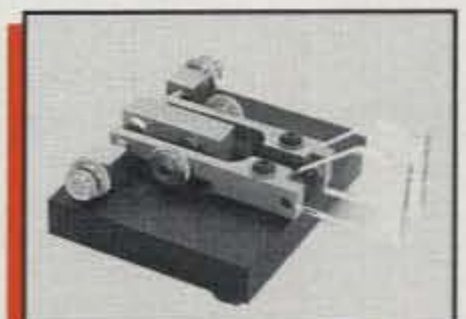
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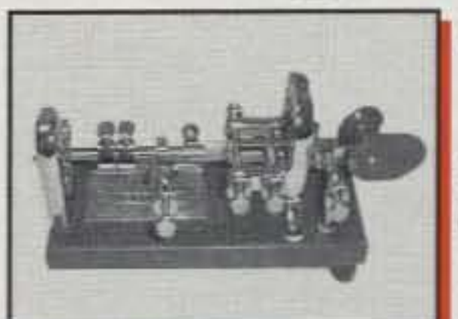
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Washington Readout

Regulatory News In The World Of Amateur Radio

BY FREDERICK O. MAIA, W5YI

What You Didn't Know About the Vanity Callsign Program

A station callsign is a radio amateur's name on the amateur airwaves, and it is very important to each of us! This month let's go into the history of station callsigns, especially "vanity" callsigns. In a future column we will cover more of the story—the actual "nuts and bolts" of how to get a callsign of your choice.

Amateur operators historically have been associated with their callsigns. In the amateur community a person is better known by his callsign than his name. Callsigns are classified according to the number of letters preceding and following the district numeral (i.e., the callsign "prefix" and "suffix"). For instance, a 1×2 (one-by-two) callsign contains a one-letter prefix, then a numeral, then a two-letter suffix. A 1×3 callsign contains a one-letter prefix, the numeral, then a three-letter suffix (e.g., W1NTK, my first callsign nearly a half century ago).

Callsign History

In 1912 the US government initially assigned callsigns consisting of only the callsign area numeral followed by two letters. When the International Telecommunications Union (ITU) developed a system of international callsign prefixes, the US began assigning 1× 2 callsigns. As the supply of 1×2 callsigns became exhausted, the FCC began assigning 1×3's. The supply of 1×3 callsigns expired at different times in the various callsign areas across the country. In the mid-1960s the FCC began to routinely assign 2×3 callsigns to new licensees and has continued to do so in recent years. Thus, a 1×2 or 1×3 callsign became the mark of an amateur licensee of long-standing and was considered to be a status symbol in the amateur community.

Similarly, W prefixes often are preferred over K prefixes, K prefixes over WA prefixes, WA over WB, etc., because callsign prefixes were assigned in that order and "older" callsigns are deemed to have higher status. N-by-three callsigns may not have the status of W-by-three and K-by-three, since N calls were routinely assigned to beginning amateurs.

Some amateurs prefer to have callsigns with suffixes that contain letters of special significance to them or to other amateurs, such as YL (young lady), DX (distance), CW (Morse code), or DF (direction finding). Callsign suffixes containing the licensees initials, name, nickname, or the abbreviation of groups or organizations with which the licensee is associated are also preferred by some amateurs. Counterpart callsigns (callsigns containing the same suffixes as previously held callsigns) are valued. Callsigns with suffixes containing letters which appear early in the alphabet are also desirable.

There are other reasons for special callsign preferences. For speed and ease of transmission, which is particularly important in long-distance (DX) contesting, where operators attempt to contact many different stations as quickly as possible, operators prefer a short callsign. For those who transmit mainly by telegraphy, a "short CW" callsign (i.e., a callsign that is easily and quickly transmitted in Morse code) is preferable. Also, a "dah" is received better in Morse code than a "dit," and this may affect callsign preferences.

Until 1976, FCC rules prohibited the assignment of specific callsigns to any amateur except for former callsigns and in-memoriam calls to club stations. The FCC's first experiment with "vanity" amateur callsigns began in July 1976 and lasted about a year and a half, ending abruptly when it was revealed that some hams and FCC officials were "bending the rules."

History of the New (1996) Vanity Callsign System

Right after the callsign scandal, the FCC adopted a new "Sequential" station callsign system. Effective March 24, 1978, "All amateur callsign policies and procedures, written or unwritten, are canceled and replaced. No requests for specific callsigns will be honored," the FCC said in a Public Notice. Stations that held more than one callsign had to submit one of them for cancellation by October 1, 1978. "No new secondary or special event station licenses will be issued." RACES, repeater, club, and military recreation station callsigns were abolished. The disappointed amateur community took this decision very hard!

Future amateur station callsigns would now be assigned in strict alphabetical order according to a list of five major groups: A, B, C, D, and X. The X Group—RACES, Club, Military Recreation, Repeaters, and Temporary station licenses—were never implemented.

Licensees were permitted to request non-specific callsigns from these "Groups" based on their class of operator license. Group A, which contained the shortest (and theoretically the most desirable) callsigns, was reserved for the Amateur Extra class. Group B went to Advanced; Technicians and Generals were allocated Group C; and Novices got the longest (2×3) Group D format. The Group callsign system remains in effect today.

How the current "Vanity" callsign system got adopted (especially after the previous one ended in scandal) is an interesting story, and one which is not generally known.

The campaign to obtain a station callsign of choice began in June 1990, when a retired Extra class amateur from Tyler, Texas—Jim Wills, N5HCT—filed a Petition for Rule Making. He wanted his old WA5EHQ callsign restored. His petition was in response to an April 19, 1990 FCC Public Notice concerning the assignment of amateur station callsigns.

Wills suggested that amateurs be allowed to specify three callsign choices in order of preference and attach a $30 fee to the FCC requesting a callsign change. "The Federal Budget and the amateur community all gain from this proposal," he said. That petition was denied because of the statutory exemption of amateur service applications from fees.

That did not stop Wills, however. He began writing to his Congressmen concerning the reassignment of unused dormant callsigns. First he contacted Senator Phil Gramm, then Representative Ralph M. Hall. The answer from the FCC was

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e-mail: <w5yi@cq-amateur-radio.com>

the same: "...Congressional intent is clear that all fees from amateur radio licensees are stricken since they do not operate for profit..." Wills also wrote to Larry E. Price, W4RA, then president of the ARRL, but got little help.

Still not willing to take no for an answer, Wills next wrote President Bush! The answer came back from the FCC's then Private Radio Bureau Chief, Ralph Haller: "...we cannot collect a fee for any amateur service application, including a fee for unused callsigns. Moreover, any amateur service fee requirement would require a statutory amendment which would require action by the Congress."

Wills then tried the National Telecommunications and Information Administration, the White House advisor on telecommunications matters. NTIA's Janice Obuchowski told Wills, "The Department of Commerce does not have the authority to regulate callsigns." She referred Will's letter to then FCC Chairman Alfred C. Sikes and added, "...you may wish to express your views to your representatives in Congress." And that he did.

On December 9, 1991 Congressman Ralph Hall again wrote to Wills saying, "I've shared your idea with the staff of the Telecommunications Subcommittee, and they are currently conducting an inquiry in conjunction with the FCC to determine whether such a fee would collect enough money to pay for itself. If so, we may be able to make the necessary legislative changes in the FCC reauthorization bill to put such a 'vanity callsign fee' into effect."

In mid-1992 FCC Chairman Al Sikes awarded K3VOA to the Voice of America Ham Club on their 50th anniversary. They were previously K3EKA. It thus appeared that waivers of the rules were possible if you knew the right people. Wills wrote another letter complaining to Sikes on June 3rd. Private Radio Bureau Deputy Chief Beverly Baker answered that letter explaining, "...the extraordinary circumstances presented in the VOA request persuaded us to make a single exception."

On June 12th a letter jointly signed by Congressmen Edward J. Markey and Ralph M. Hall was sent to FCC Chairman Sikes. It said, "We are writing to you on behalf of several amateur radio operators who are interested in the establishment of an FCC system for allotting distinctive callsigns. Such callsigns would be available at a fee to radio operators, in order to recover the total cost associated with the program." The addition of Markey's signature to the letter added renewed importance! Markey controlled the FCC budget.

The answer this time came from Chairman Alfred C. Sikes himself! He said that the FCC had been unable "...to establish a system of distinctive callsigns because of the specialized handling, resource limitations, and the inability of our current computer system to perform this specialized function. A distinctive callsign program would require a new automated system at an approximate cost of $250,000." He added, "...Congress has not given the FCC the legal authority to retain the fees collected to offset program costs."

On January 13, 1993 Congressman Hall again wrote to Jim Wills: "Al Sikes raises a legitimate complaint about the lack of FCC resources, but he misses the point Ed Markey and I were talking about when we sent our June 12th letter to the Commission Chairman. A self-funding program of granting special callsigns to ham radio enthusiasts would not place additional demands on FCC resources as long as the FCC set fees at an appropriate level. I was not aware of the statements made by Amateur Radio Bureau [sic] Chief Haller, but it appears that—with or without the knowledge of Chairman

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Sikes—the FCC is already moving towards implementing a specialized callsign program. It's important to note, however, that the FCC will still need permission from Congress to collect fees. My staff has already started discussion about this issue with the staff of Telecommunications Subcommittee Chairman Ed Markey. I'm confident that he will support a legislative proposal which would allow the FCC to collect fees for specialized callsigns."

Both the House of Representatives and the U.S. Senate approved legislation authorizing the Federal Communications Commission to issue unique amateur station callsigns at an initial cost of $7.00 per year to the ham radio community. (It was later reduced to $3.00.)

President Clinton lobbied long and hard to get his Deficit Reduction Plan through Congress. It passed the House by only two votes (218 to 216), and Vice President Al Gore had to break a 50-50 tie in the Senate. Clinton signed the measure into law on Tuesday, August 10, 1993.

It was a big surprise to the FCC and the ARRL! Neither were aware of the short, four-word line in President Clinton's well-publicized Deficit Reduction Plan that would allow the Commission to issue special "vanity" callsigns to the amateur community upon payment of a fee. Under "Schedule of Regulatory Fees" were the words "Amateur vanity call-signs: $7 [a year]."

At the Annual VEC Conference in June 1993, Personal Radio Branch Chief John B. Johnston, W3BE, told the VECs, "A new computer system coming on line shortly is being programmed, however, to provide personalized Amateur callsigns which would require a fee." He added, "...in the future it might be possible for Amateurs to obtain any unassigned callsign."

The special callsign program still had to go through rulemaking before it could be implemented by the Private Radio Bureau, a lengthy process that normally takes a year or more.

The American Radio Relay League formed an Ad Hoc Committee on Vanity Callsigns. They concluded that the vanity callsign system should be phased in with a series of four three-month windows before opening the system to all. Previously held callsigns regardless of license class, format, or call district should be available first. The second, third, and fourth windows would be by license class. The committee also felt that the fee should be a one-time ($150) occurrence rather than $70 every ten- year license term.

The FCC's version of vanity callsigns was adopted on December 13, 1993. PR Docket 97-305 provided for allowing amateur radio operators to select any unassigned callsign of their choice.

The FCC envisioned that a station callsign would become available for reassignment after two years following license expiration or the death of a licensee, whichever is sooner. The FCC did not propose any type of "phase in" program. Instead, all callsigns would become available on a first-come, first- serve basis. This feature was very controversial!

The callsign selected had to be within the framework of the sequential callsign system wherein certain groups of callsigns are designated for each class of operator license. In other words, a Novice could not choose an available Group A Amateur Extra callsign. Amateurs could hold only one primary station callsign and must relinquish their current callsign when a chosen "vanity" callsign was assigned.

A new FCC Form 610-V would permit the amateur to choose a maximum of ten callsigns in order of preference. While Congress set a $70 fee for a ten-year term "vanity" station call-

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sign, the ARRL wanted this changed to a one-time $150 processing fee, and they set about lobbying Congress for the change.

A year later (December 23, 1994) the FCC Commissioners adopted final rules implementing vanity callsigns in the Amateur Service. There were not too many surprises in the information contained in the preliminary press release, but there were some. Here are some excerpts from that Order.

A major concern of the amateur service community is that the system adopted for allocation of vanity callsigns be fair and equitable. Specifically, many commenters suggested using a method of priority with respect to filing applications for vanity callsigns. The ARRL's suggested method is to open the system gradually through four "starting gates."

Given the strong interest in vanity callsigns shown in the comments, it is obvious that the number of applications filed initially could be very large. We agree that a filing priority schedule would be helpful in maintaining fairness and efficiency during the initial implementation of the system, as well as ease administrative burdens on the Commission.

The suggestions concerning giving the highest filing priority to former holders and close relatives of deceased holders appear to be perceived as fair by the amateur service community generally, as does the giving of high priority to those who hold the higher classes of operator license.

Information on the class of operator license held by each amateur operator, moreover, resides in our licensee data base and lends itself to an automated process. Information on the length of time a person has been an amateur operator is not readily available, thus making that criterion impracticable to use as the basis of a filing priority schedule. Thus, after all amateur operators have been given an opportunity to obtain callsigns that they, or deceased close relatives, formerly held, we will use operator license class as the basis for the filing priority schedule. In this regard, we are adopting the ARRL's suggesting starting gates.

The FCC said it would announce the opening of each gate by a Public Notice:

The first gate will open as soon as our new FCC Form 610-V is available (it was issued on November 30, 1995) and our licensing facility is prepared to begin processing the applications.

Gate One will open the system to the smallest group, i.e., a few thousand prior holders and close relatives of deceased prior holders. We define close relatives as the spouse, child, grandchild, stepchild, parent, grandparent, stepparent, brother, sister, stepbrother, stepsister, aunt, uncle, niece, nephew, or in-law of the deceased.

The FCC went along with the ARRL's suggestion that an applicant be permitted to submit a preferential list of 25 callsigns, thus increasing the chances of requesting an assignable callsign.

One point that the FCC did not go along with was the ARRL's request that an applicant only be permitted to request those callsigns that are assignable to stations in the callsign region where the licensee resides. The FCC said it carefully considered this suggestion and decided not to impose that limitation since "...the applicant's choice of vanity callsigns would be reduced to ten percent or less of the callsigns that would otherwise be assignable to the station. A limitation based upon the person's place of residence, moreover, could easily be circumvented by using a mailing address in another callsign region."

The ARRL promptly filed a Petition for Reconsideration on this issue, which was again denied by the FCC. The Commission also elected to impose a two-year waiting period before a vacated callsign could be reassigned. There were also three other Petitions for Reconsideration filed.

On December 23, 1994 the Federal Communications Commission adopted rules to implement a vanity callsign system in the amateur radio service. The vanity callsign system initially was to be implemented by means of four starting gates as requested by the ARRL. This was later changed to five gates to accommodate clubs that wished to obtain the callsign of a deceased member. A public notice would announce the opening of each gate.

On June 14, 1995 the FCC adopted a revised Schedule of Regulatory Fees for Fiscal Year (FY) 1995. Effective September 19, 1995, the annual Regulatory Fee for Vanity Callsigns selected by the user was reduced to $3.00 instead of the initially suggested $7.00. Payment for a vanity callsign had to be submitted with the application and "shall include an advance payment of the total annual regulatory fee payment due for the entire term of the license..."

There was no guarantee, however, that amateur vanity callsigns would remain at the $30 level for a ten-year term—and they did not. The rules provide that regulatory fees can be adjusted annually if the actual cost of the services provided increases or decreases over the initial projection. The fee was increased to $50 effective September 15, 1997. Since then it has been reduced to $14.

By the way, Jim Wills, N5HCT, was issued the vanity callsign W5JIM on November 4, 1996.

In our next installment, we will tell you exactly what you need to know to go about getting an amateur station callsign of your choice. There really is a lot to it. You have to know which callsigns are, and are not, available, and for what callsigns you are eligible. There are also many ground rules that you need to follow. For example, certain callsign formats are only available to certain license classes and geographical areas.

73, Fred, W5YI

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Beginner's Corner

BY PETER O'DELL, WB2D

For the Newcomer to Ham Radio

HF Nets

Last month we looked at a typical VHF/UHF repeater net and how it operates. This month we continue with its HF counterpart—actually, "counterparts" would be more accurate. The variety of net operations found on VHF/UHF frequencies is rather limited. For the most part, you are going to find the semi-formal operation described last time, or maybe a traffic net (we'll look at those in more detail next time). That's about it.

On HF, however, things are a lot more varied. It is sort of like going to EPCOT at Disney World. Turn the dial a few Hz, and you enter a totally different world of strange and unusual characters. Like EPCOT, most are friendly, too. This variety is particularly true of the 75 meter phone band in the evenings and very early mornings, or during the day on 20 meters. Nets can be found on any band at just about any time, though.

What kind of nets can you find? What kind do you want? There are nets for all aspects of ham radio—traffic handling (obviously), slow-speed CW, moon bounce, satellites, county hunting, slow scan TV, AM operation. If it can be done legally on the radio, there is probably a net for it. There are nets for all sorts of non-ham activities as well: Computers are big, and so is collecting of all sorts.

One of the best investments that you can make is to buy a copy of the ARRL's *Net Directory*; it's only $4.00. Not only does it list most net activity (well, at least most of it that is conducted in English), but there are several articles and tutorials on net operation. Another good source of information about net operation is the *ARRL Operating Manual*. If you just need the time and frequency of a net, then you can log onto the ARRL website (<http://www.arrl.net>) and get access to the database listings of nets. Maybe it is my advanced years, but I find the hard copy of the listings in the *Net Directory* to be much more informative. Just scan down the page and notice all the interesting flavors of nets to be found on HF.

Rules

What are the rules and regulations of net operation? They are the same as for any other on-the-air activity. In other words, there are no special rules for nets. They are not given any special consideration in the FCC rules. That being said, though, there is something called "good amateur practice." This means that reasonableness and common courtesy are expected by the powers that be. In other words, a net does not own a frequency. However, a net has a lot of people, and to be successful it must have an established time and frequency—*plus or minus the QRM.*

If you are on frequency at net time, it is going to be a lot easier for you to move up or down a little and continue your QSO than it will be for the net control station to find a new frequency and communicate this new spot to the hundred or so participants via psychic means. The variations of HF propagation can further complicate this. There will be times when some stations will not be able to hear the net control station. Here is where "good amateur practices" really weigh in.

It just boils down to this one simple idea: be courteous. Yes, you may have set up shop on a particular frequency ten minutes before the net, but you don't own it either. Be a gentleman/woman. Let the net have the frequency. Incidentally, some nets arrange for a couple of net members to show up on the net frequency a few minutes before net time. They establish a QSO, and then turn over the frequency to the net when it is time to start.

The rules for identifying come into play in net situations, too. You are required by FCC rules to identify "at the end of each communication or at least every ten minutes during a communication." Obviously, if you have a hundred check-ins, you cannot stop the reg-

ARRL QN Signals
For CW Net Use

QNA*: Answer in prearranged order.
QNB*: Act as relay Between ___ and ___
QNC: All net stations Copy. I have a message for all net stations.
QND*:Net is Directed (controlled by net control station)
QNE*: Entire net stand by
QNF: Net is Free (not controlled)
QNG: Take over as net control station
QNH: Your net frequency is **High**
QNI: Net stations report **In**. I am reporting into the net (Follow with a list of traffic or QRU.)
QNJ: Can you copy me?
QNK*: Transmit messages for ___ to ___
QNL: Your net frequency is **Low**
QNM*: You are ORMing the net Stand by
QNN: Net control station is ___. What station has net control?
QNO: Station is leaving the net.
QNP: Unable to copy you. Unable to copy ___.
QNQ*: Move frequency to ___ and wait for ___ to finish handling traffic. Then send him traffic for ___.
QNR*: Answer ____ and Receive traffic.
QNS: Following Stations are in the net.* (Follow with list.) Request list of stations in the net.
QNT: I request permission to leave the net for ___ minutes.
QNU*: The net has traffic for **you.** Stand by.
QNV*: Establish contact with _____ on this frequency. If successful, move to – and send him traffic for ___.
QNW: How do I route messages for ___?
QNX: You are excused from the net.* Request to be excused from the net.
QNV*: Shift to another frequency (or to ___ kHz) to clear traffic with ___.
QNZ: Zero beat your signal with mine.

**For use only by the Net Control Station.*

Table I– "QN" signals for net operation.

*123 NW 13th Street, Suite 313, Boca Raton, FL 33432
e-mail: <wb2d@cq-amateur-radio.com>

ular activity of the net so that each station can say its callsign every ten minutes. You would never get to the reason the net meets. If the net control station calls on you, just throw in your callsign at the end of your transmission. Something like this will work: "WB2D back to net." Or on CW, it simply will be, "de WB2D K." *(The intent of the FCC rule is to identify who's transmitting, not who's listening. Thus, a station standing by on a frequency does not need to transmit solely in order to identify, as long as you identify the next time you transmit.—ed.)*

As mentioned last time, it is a good idea to listen to a session or two of a net before jumping in—particularly if HF net operation is new to you. Most nets will begin with a preamble that tells you the net's name and subject matter, plus some idea of how formal or informal it is. The net control station (NCS) is going to ask for check-ins, and he may give specific instructions about which stations should check in first. Pay attention! Follow the NCS's instructions and the general format used by other stations.

If after listening for five minutes you realize that there is a much better way of running things, you may feel tempted to just jump in and tell NCS what he should be doing instead. This is sure to get you immediate *recognition,* but if another net operator lives near you, you may wake up the next morning to find a dozen or more nails driven through your coax. Nets are creatures of habit—some good, some not so good. However, they are habits, and habits make us comfortable. For most people, comfort ranks a lot higher than efficiency on their internal top ten scale. When you pay your dues and work your way up to NCS, then, and only then, will you be able to introduce your new and improved efficiency changes in the net.

Last time we emphasized the importance of using standard phonetics for net operation on repeaters. It is doubly important on HF SSB nets. Fading and QRM can make copy very difficult. Standard phonetics will ensure that you get the most out of your net operation.

CW Nets

On to CW nets: If you are comfortable with CW at moderate speeds—25 to 30 wpm or so—you should be able to handle most local traffic nets. If your comfortable speed is a little lower than that, then you might want to start with a slow-speed net of one sort of another. There are a few listings for slow-speed traffic nets in the *Net Directory,* but there may be even better choices to start with.

One of my favorite groups around the CW circuit is FISTS, which is an international group dedicated to the preservation and *fun* of CW. This is an informal group with a small newsletter (hard copy or e-mail) and numerous on-the-air activities, including various slow-speed nets. Nancy Kott, WZ8C, is the US representative for the group. You may contact her at P.O. Box 47, Hadley, MI 48440-0047, or via e-mail at <nancy @tir.com>. If you want to have fun with CW, I do not know of a better group to hook up with. A recent copy of the FISTS newsletter listed slow-speed nets for almost every day of the week.

One further comment on FISTS: You don't have to be a CW superstar to join. If you can manage 5 wpm or so, you will find someone to communicate with. Some CW groups can be a little on the snooty side at times with those of us who can't keep up with their speeds. You won't find that here. FISTS even has a "code buddy" system to match you up with a more experienced CW operator who will guide you along the road to having fun on CW. It is a good group. Check it out.

If you get active in CW nets, you may begin to hear unfamiliar Q signals. These "QN" signals are in addition to normal Q signals, and are a special set of signals developed in the 1940s by Midwest hams and adopted by the ARRL. These signals should *only* be used during net operation. See Table I for a list of these signals and what they mean.

The *ARRL Operating Manual* has the transcript of a typical CW traffic net. Studying the transcript is a good way to quickly get a grasp of what is going on—particularly after you've listened in on one or two sessions.

Next month we will take a detailed look at traffic handling and message construction.

Feedback and Feedforward

Norm Beavers, W3DYA, of Tyler, Texas, writes, "I did want to comment on your 'Contests' column, which was over two pages long and covered a lot of contesting info. However, since *CQ* sponsors the county hunting award (USA-CA), I was disappointed you didn't mention the many good state QSO parties (contests) as a learning ground for contesters.

"I have never been interested in the certificates, and never applied for WAS, WAZ, and the usual awards beginners attack right away. Unfortunately, I accidentally learned about county hunting and *CQ*'s USA-CA program in 1967. I say 'unfortunately,' because once you get involved with the county-hunting group, it's like an addiction. The people are great, chasing counties is fun, and you look forward to each state QSO party in your quest for finishing a state."

Norm goes on to describe how much fun county hunting is for him. Read the rest of his letter in the Beginners Forum on the *CQ* website at <http://www.cq-amateur-radio.com>.

Bob Shrader, W6BNB, of Sebastopol, California, writes, "First, since most of us file our received QSLs in a box or drawer in numerical/alphabetical order, we have to finger through the older ones to find out where to place the newest ones. This means fingering through a whole group of tall and short cards to find where to put the new ones. All QSL cards should be 3 1/4 inches tall! I checked hundreds of cards before coming up with this. The widths are not important, but the height is. I have had to cut down many QSLs to fit into my files of cards. This has cut off interesting and desirable parts in many cases."

Bob has some other interesting ideas about QSLs. Check the *CQ* website's Beginner's Forum for his complete letter, too.

Feedforward? My spell checker says there is no such word, and it is probably right. This is your chance to have some input on what goes into this column. Write me a letter (better, an e-mail) and tell me what you want to see covered.

73, Pete, WB2D

Correction

In the September 2000 column on page 86 we ran a table of ARRL incoming QSL bureau addresses. The Canadian VE5 listing should be as follows: Bjarne Madsen, VE5FX, P.O. Box 2860, Tisdale, SK SØE 1TØ Canada.

Call for Photos and Stories

We'd like to hear from you about your experiences as a newcomer. If you have questions, we'll try to incorporate them into future columns. If you have photos (color prints or slides okay) of your station or antennas, please send them along and we'll publish the best ones. If you have a solution to a common problem that new hams experience, we'd like to hear about it so we can pass it along. You can contact me at <wb2d@cq-amateur-radio.com> or Peter O'Dell, WB2D, Beginner's Corner, 123 NW 13th St., Suite 313, Boca Raton, FL 33432.

How It Works

BY DAVE INGRAM, K4TWJ

Theory 'n Practice

More Notes on Detectors, Mixers, and IFs

As you will recall, our previous "How It Works" column presented an introduction to mixer, IF, and detector circuits and briefly explained their purpose in modern shortwave receivers. We also covered the concepts of single conversion, double conversion and up conversion as used in today's SSB/CW receivers and transceivers. That column covered a large amount of ground, but some special notes and always useful information still could not be squeezed into available space. Let's thus begin this time with a few more notes of interest and then bring in basic operating concepts and frequency relationships used in modern SSB/CW transmitters.

This and the aforementioned other column may give you the impression we are on a heavy technical roll, but bear with us and we will lighten up on the complexities in future columns. With this solid foundation to our credit, we then can discuss hot topics such as IF Shift and Pass Band Tuning, crystal filters and mechanical filters, automatic antenna tuners, DSP, etc., and point out the benefits each offers you. We are moving in some exciting new directions, and a wealth of knowledge waits to be shared (now and in future columns), so let's get started!

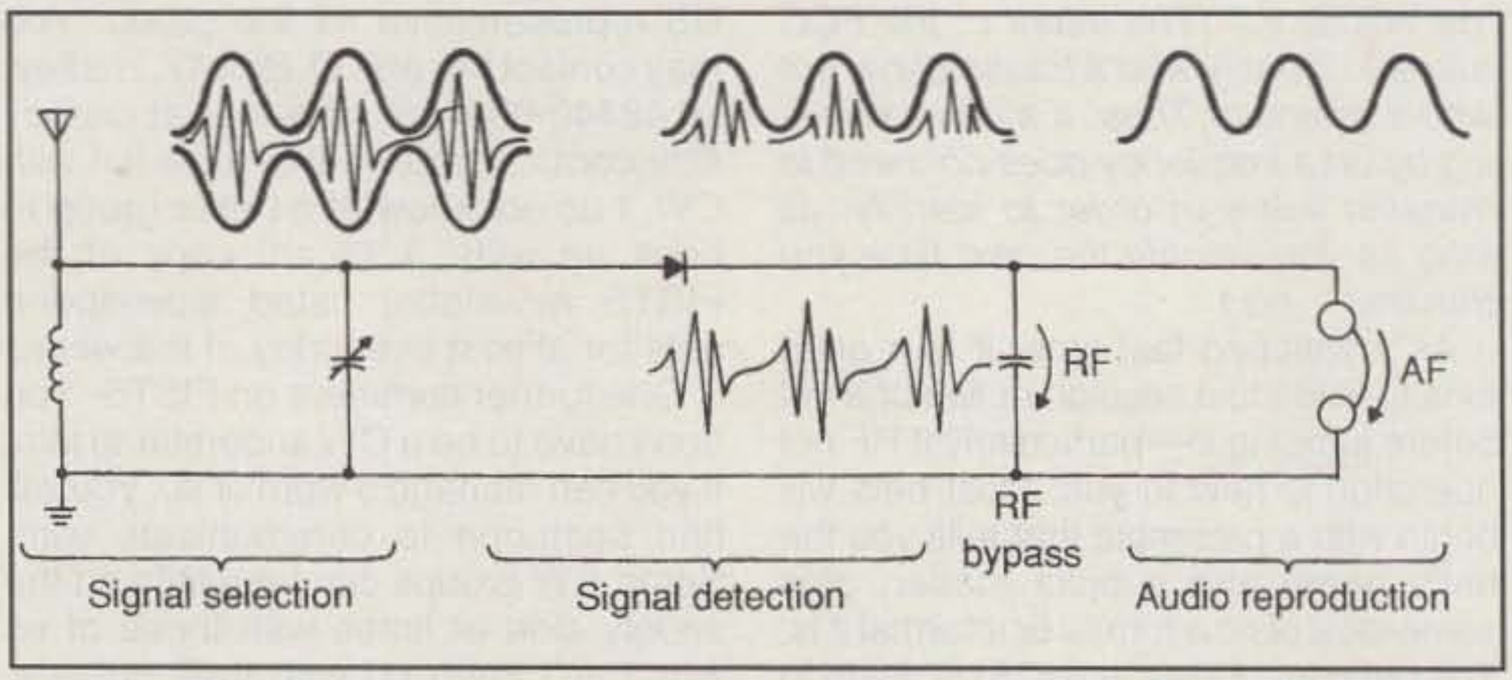

Fig. 1– Circuit diagram of a very early and easy-to-understand receiver. Unit contains basic stages of signal selection, detection, and audio reproduction. (Discussion in text.)

Detectors as Mixers

Remember last time when we discussed early AM broadcast band reception with a simple crystal set like that shown in fig. 1? We described the diode detector's action from the traditional standpoint of rectifying a signal's modulation envelope to recover transmitted audio. Well, friends, there is another (and quite interesting) way to visualize a diode's operation: It also acts as a mixer. Refer to fig. 2 for a quick explanation.

When a transmitter's full key-down signal or RF carrier is modulated by audio frequencies (voice), those frequencies appear on each side of the transmitted frequency as sidebands (lower and upper). A diode then mixes, or "beats," the carrier frequency (such as 610 kHz) with one of the sideband's frequencies (611, 612, 613, 614, and 615 kHz, for example) and produces, or "outputs," the audio difference frequencies (such as 1, 2, 3, 4, and 5 kHz). But wait, you say. Doesn't a mixer need two incoming signals to mix or "beat together"? Yes indeed, and the two signals in fig. 2 are the carrier and one of the sidebands. Eliminate the carrier or either sideband and the diode no longer acts as a mixer—that is, unless an external oscillator's signal is injected into the detector circuit to serve as a Beat Frequency Oscillator (a BFO, as used to copy CW or SSB).

Using diodes as mixers is not a new or unusual idea. In fact, the concept has been employed for many years—in everything from homebrewed QRP gear to modern UHF, VHF, and HF transceivers (fig. 3). Why? Generally because they are *passive devices* rather than *active devices* and thus exhibit less conversion noise and a wider dynamic range than active devices. Say what?

Familiar mixing devices such as tubes, transistors, and ICs like those illustrated in photo A are "active" devices: They require an operating voltage and also deliver some signal gain when mixing or converting frequencies. The signal gain is good, but resultant noise and susceptibility to overload from strong signals may cause distortion and intermod on receive. Diode mixers are passive devices: They do not require operating voltage, do not produce any signal gain, and are thus less susceptible to overload and noise. Lack of "conversion" gain is usually overcome or offset by preceding the mixer with a front-panel selectable *RF preamp.* Now let's add some interesting side notes.

Look closely at specs of a transceiver with a panel-selectable RF preamp, and you will notice its lowest noise figures and widest dynamic range occur when the preamp is switched off. Notice, too, switching the preamp on increases sensitivity to both weak and strong signals and lowers the dynamic range. Have you ever heard "buckshotting," or changes in receiver gain, when listening to a weak signal on, say, 14.226 MHz while a strong station was transmitting on, say, 14.238 MHz? If the strong station was not "splattering" from excess microphone gain, your transceiver's front end was probably over-

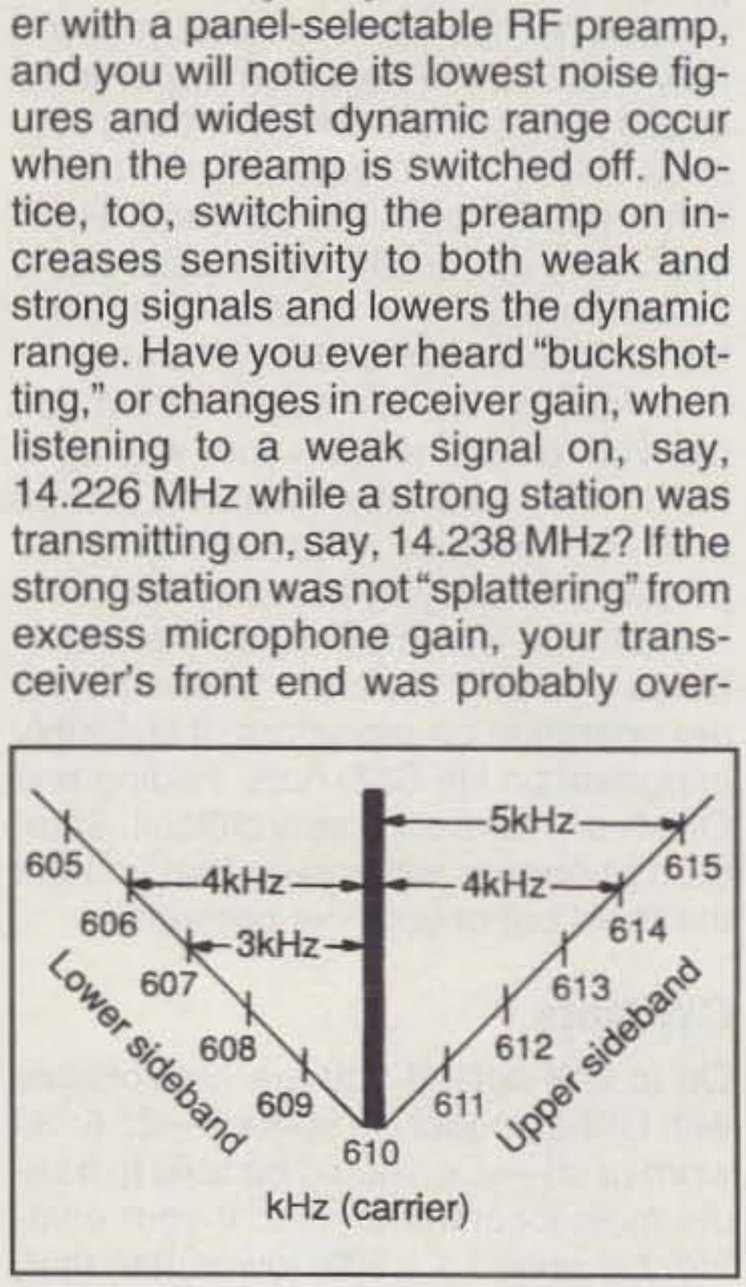

Fig. 2– Frequency analysis of a double-sideband AM signal. Note difference between RF energy in sidebands and carrier are audio frequencies.

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e-mail: <k4twj@cq-amateur-radio.com

← *Photo A– Three familiar types of "active" devices that function as mixers and/or product detectors pose for a family portrait. Items are (left to right) vacuum tube, bipolar transistor, and NE602 IC. (Discussion in text.)*

Photo B– MFJ's new "CUB" QRP transceiver uses surface-mount-type NE602 ICs for mixers and product detectors, and it works like a champ. →

loading from too much RF pre-amplification or too much conversion gain. This is a hot area of study and development in modern transceivers. Every manufacturer strives to produce a rig that can copy one very weak signal amidst a mountain of super- strong signals, and it is a formidable challenge.

Here's another point: A transceiver's RF preamp may not be labeled accordingly. Check your rig's manual and block diagram. Some Kenwood transceivers, for example, leave an RF preamp in line, and you can bypass it with a front-panel "AIP" button (Advanced Intercept Point switch) for greater dynamic range.

Now one final point: Sometimes unusual items such as rusty bolts can act like (undesired) diode mixers. Have you ever experienced TVI or RFI when your transceiver was "clean" of harmonics and/or spurious signals? Check coax connections right at their point of contact with wires, washers, and bolts on your antenna *and on the TV set's antenna connections*. Oxidation and/or rust can turn a poor connection into a sort of poor diode, which mixes your signal with numerous other signals in the air and produces new frequencies when you transmit. If one of the new frequencies "hits" an FM or TV channel, RFI or TVI results. Fortunately, rusty-bolt rectifiers are not too common!

Mixers as Detectors

We considered how detectors can serve as mixers, now let's briefly discuss how mixers can be used as detectors. Actually, the proper term here is *product detector*—that neat little circuit that makes a Donald-Duck-sounding SSB signal readable or produces an audio tone from a CW signal. Again, let's use an easy-to-understand QRP circuit rather than a more complex "big rig" circuit for explanation (fig. 4).

In this example (which, incidentally, was extracted from MFJ's hot new "CUB" QRP transceiver shown in photo B), a popular NE602 IC serves as a product detector. An incoming IF signal on 10.000.1 to 10.001.1 MHz (which was down-converted from 14.2 MHz by another NE602 in a previous stage) is passed through a three-crystal IF filter and applied to pin 1 of the (product detecting) NE602. Simultaneously, the tuned circuit on pins 6 and 7 resonate the NE602's internal oscillator on 10.000 MHz. The difference, which is 100 Hz to 1100 Hz, is then output on pins 4 and 5 and consequently boosted in level by an LM386 audio amplifier IC. One of the CUB's NE602s served as a front-end mixer. Another NE602 served as a product detector. The only difference was in values of external support components and applied frequencies. Other devices such as vacuum tubes

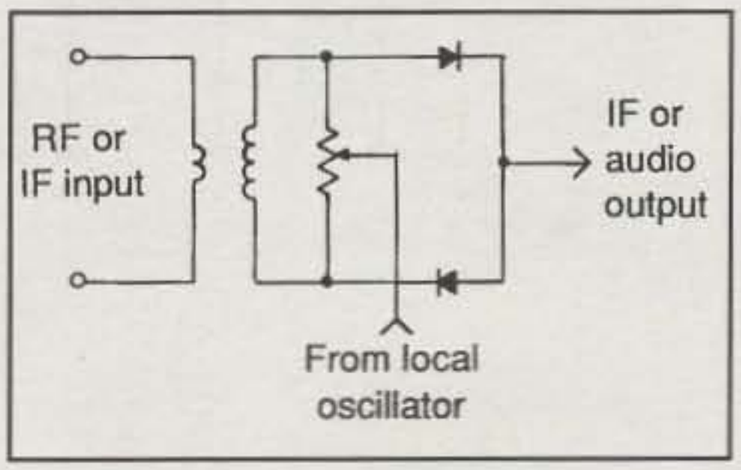


Fig. 3– This simple dual-diode circuit is found in several types of homebrewed QRP gear. It will function as a mixer or as a product detector, according to applied frequencies. The same general concept with more elaborate circuitry is incorporated in mixer stages of several modern transceivers.

and transistors also make good product detectors; just apply appropriate input/beat frequencies and amplify audio available at their output. We will discuss detectors more in future columns. Meanwhile, let's go over the general operating concepts of modern SSB transmitters.

Mixers and IFs in SSB Transmitters

Last time we wrapped up with a discussion of mixing, or frequency conversion, concepts as applied to SSB receivers. This time let's follow suit with a similar discussion of mixers and frequency relationships in SSB transmitters. Although generic frequencies will again be utilized for ease of understanding, our double shot of information should prove quite valuable for understanding how complete transceivers work later down the line. Let's thus focus on the block diagram of a "no-name" SSB transmitter shown in fig. 5.

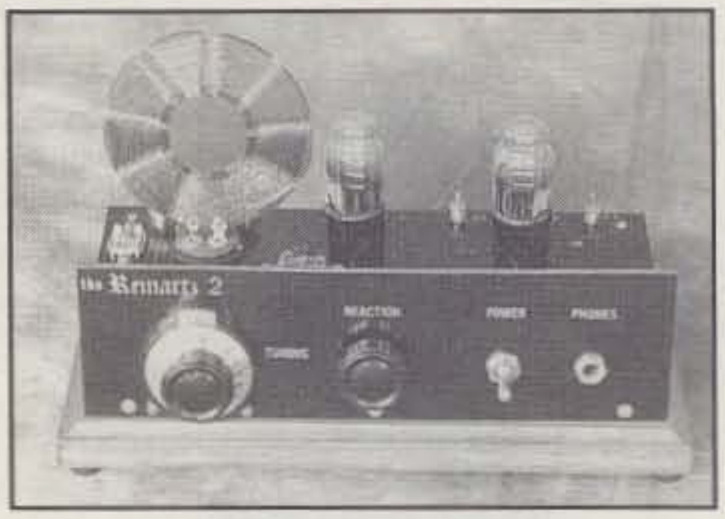
Starting at the microphone, audio in the approximate range of 100 Hz to 5 kHz is amplified and applied to one input of a mixer serving as a balance modulator. Simultaneously, an approximate 9.00 MHz signal is produced by the carrier oscillator and directed to the balance modulator's other input. The difference between those two input frequencies or 9.000.1 to 9.005.0 MHz, corresponding to 100 to 5 kHz of audio, is then output from the balance modulator. Technically, we could say the balance modulator nulled, or "balanced out," the (AM) signal's carrier (on 9.000.0 MHz) and left a double sideband signal.

The following 9 MHz crystal filter has a sharp response of 9.000.3 to 9.002.8 MHz, or an overall width of 2.5 kHz. It thus "filters out" one sideband and narrows the remaining sideband's width to 2.5 kHz. The resultant 9 MHz SSB signal is then IF amplified and applied to input number 1 of the IF mixer, while a second oscillator signal on 64 MHz is applied to input number 2. The sum of those two frequencies, or 73 MHz (actually, 73.000.3 to 73.002.8 MHz with modulation) is then directed from the mixer's output to the IF amplifier's input. The 73 MHz signal is then boosted in level and applied to input number 1 of the VFO mixer. Meanwhile, a main tuning signal from the VFO is directed to input number 2 of the mixer. The VFO's

A Blast from the Past

During the early days of radio, shortwave receivers employed self-oscillating, or regenerative-type, detectors to copy both AM and CW signals. These little marvels often used only two vacuum tubes—one detecting or direct-converting RF signals to audio, and the other serving as a basic audio amplifier. A heartwarming example of one such receiver I am sure you will enjoy seeing is the famous spider-web-coil-equipped "Reinartz 2" shown in the accompanying photo. Now this is a real glow-in-the-dark radio! Stunning, isn't it?

Although strictly "bare bones" in circuitry (no RF amp, mixer, crystal filter or IF stages), regenerative receivers were (and still are!) surprisingly sensitive critters. In fact, many amateurs still build and use them on the air with similar old-time, one-tube transmitters just for fun. Listen for them on 160, 80, and 40 meters CW during annual Antique Wireless Association vintage-rig contests. The "boys and their toys" sound great and have a ball!



This magnificent replica of a classic 1920-style regenerative-detector-type receiver was offered as a kit during the 1980s by Dick Smith Electronics of Australia. Although no longer available, some enthusiastic amateurs still build home-brew equivalents right from scratch—and they copy CW and SSB signals surprisingly well on today's bands. What a thrill! (Photo courtesy proud owner Robert Root, WD6DPU)

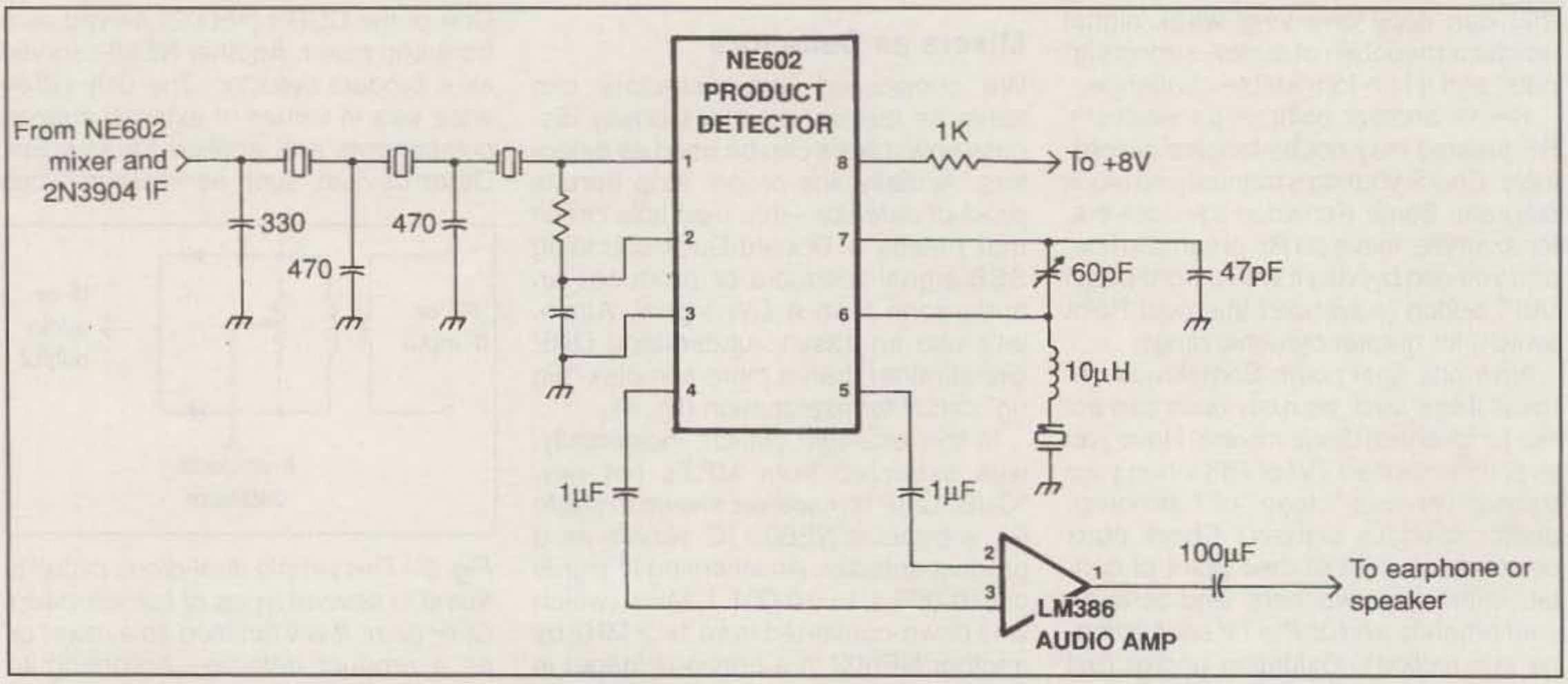


Fig. 4– A popular NE602 IC forms the basis of this product detector circuit used in the new MFJ "CUB" QRP transceiver. An IF signal is applied to pin 1, a local oscillator's frequency is generated internally and stabilized by the crystal on pins 6 and 7, and resultant audio is output at pins 4 and 5. (Discussion in text.)

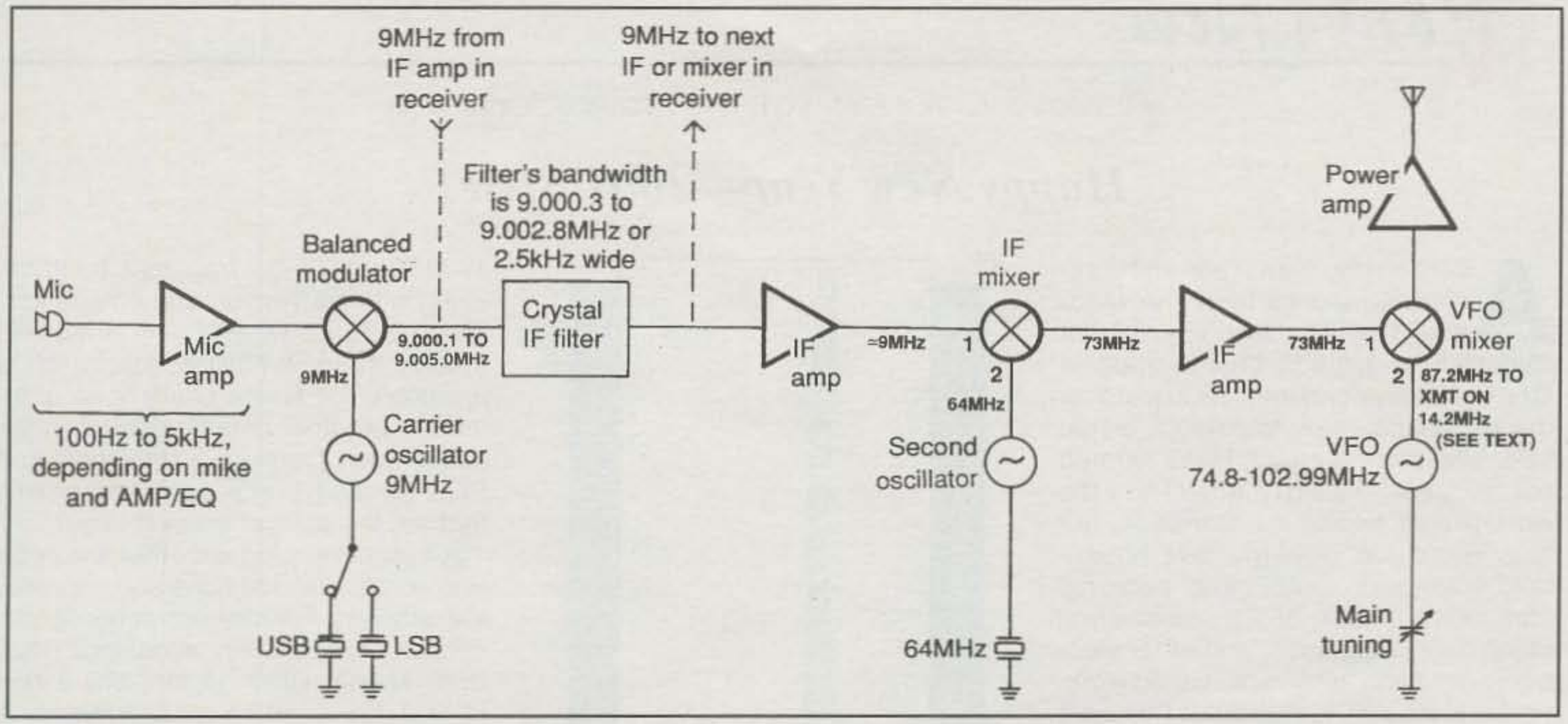


Fig. 5– Block diagram of a generic SSB transmitter. This particular diagram was sampled from a license exam test question. (Full discussion in text.)

frequency will be between 74.8 MHz (for a 1.8 MHz/160 meter output signal) and 102.99 MHz (for a 29.99 MHz output signal). A VFO signal of 87.200 MHz would produce (87.2–73.0) 14.200 MHz. Get the idea?

Space is now tight, so let's add some quick final notes before signing off for another month. Why so many frequency conversions and IF amplifiers in a transmitter, you ask. Why not simply mix once (like shifting the second oscillator to cover 5.000 to 5.350 MHz for output on 14.000 to 14.350 MHz) and call it even? That is a logical thought, but the output signal would not be as squeaky clean. Additional IF filtering minimizes "birdies" and "spurs." Those additional crystal filters are located *after* each amplifier stage. They are not shown in fig. 5 because our sample circuit is an exact copy from an Extra Class license exam test question (yes, the question-pool committee left out the filters!). Notice receive signals can also pass through the 9 MHz filter *after* the balance modulator. Nine MHz is a generic example here. A modern SSB transceiver usually has one (and sometimes more) main filter—on 9 MHz, 455 kHz, etc., and using them double-duty style on both transmit and receive is both logical and economical. Finally, NE602s make good all-around mixers and product detectors, but equivalent custom-designed ICs are more popular in imported rigs.

Once again I urge you to review the presented figures and frequencies a few more times and then congratulate yourself if all the fine points and frequencies make sense. You are a technically sharp radio amateur! Yes, and with this building block to our credit, we are ready to discuss some exciting topics such as new transceiver designs, sharp signal filtering versus great-sounding audio, and much more in future columns. Stay tuned!

73, Dave, K4TWJ

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B1-1KV	1:1	1 KW SSB	15 - 2 m VHF balun	$27.95
Y1-5K	1:1	5 KW SSB	160-10m "YagiBalun"	$35.95
B4-1KXV	4:1	1 KW SSB	15 - 2 m VHF balun	$31.95
B4-2KX	4:1	2 KW SSB	160-10m Precision	$45.00
RemoteBalun		High power 4:1 for ladder line		$49.95

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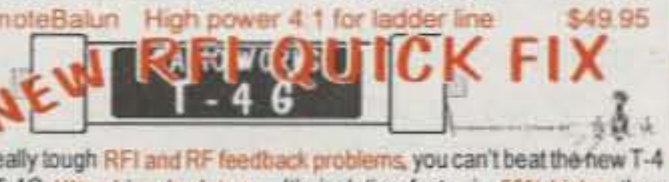

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Jim's New Book - "Frequently Asked Questions about Antenna Systems and Baluns." This 120 page book answers questions and dispels myths. The material is presented in a style that's easy to read and Jim, W4THU, is not beyond poking fun at jealously held concepts that don't quite hold up under close scrutiny. However, at the heart of this book are questions that a lot of hams ask over and over again. Available now - $10.95 + $3 postage.

Antenna Wire and Parts

"And, not a dog in the bunch!"

PL-259ST	Silver-Teflon, U.S.A.	SALE	$1.00
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R1 Rotator	8 conductor (2 x #18, 6 x #24	SALE	26¢/20¢
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#14 HD	Stranded, 7-conductor hard-drawn		8¢
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#13 Insulated	Very tough jacket, strong, for heavy weather		16¢
450 Ladder	#16 stranded conductor, poly.	SALE	22¢/16¢
450 Ladder	#14 stranded conductors, poly	SALE	30¢/24¢
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What's New

BY KARL T. THURBER, JR., W8FX

A New Column for A New Century

Happy New Year—2001 Style!

A very Happy New Year and Season's Greetings to all our readers—the first New Year of our "What's New" column. Last year at this time I was very concerned as to just how the upcoming "Y2K transition" would fare. Like most readers, I was worried not only about the big picture of how the world would handle the transition, but also about just how my own household's amateur radio gear, personal computers (PCs), VCRs, answering machines, telephones, and other electronic gear and appliances would work. Fortunately, Y2K turned out to be no big deal for most of us, didn't it?

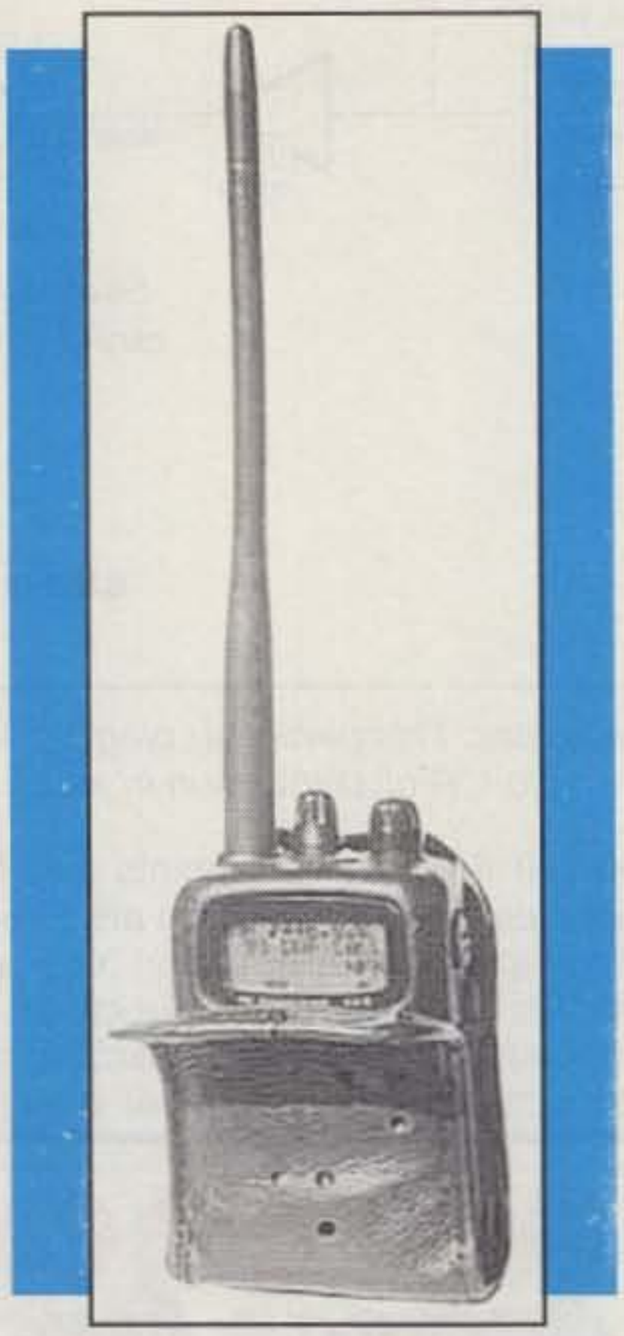
This month we have a full plate, so let's get started.

Accessories for the Shack

PowerPort™ Accessories from Cutting Edge Enterprises. Recently, we noticed a number of ads for a wide variety of PowerPort accessories offered by Cutting Edge Enterprises. The firm makes portable power supplies, pouches, bags, and other handy communications accessories.

According to President Roger Hall, his product line originally was a response to "a restless inventor's needs." His fascination with both wilderness travel and electronics made the lack of adequate portable equipment painfully obvious, and he set out to design a topnotch, rigorously tested line of hand-portable power supplies and communications accessories. Roger says all his products are designed to be easy to use, comfortable to carry, and sturdy enough to hold up to serious wear and tear.

One very popular and stylish product is the VX-5 Radio Glove. It's an attractive pouch of fine glove-quality leather to protect your radio, address some of the shortcomings of standard pouches and belt clips, and look great while doing it. The design series runs from the classic Radio Glove™, as pictured, to the innovative Radio Badge which you can wear on your lapel, the Pocket Pro for your shirt pocket, and the Radio Holster, which slips on your belt in antenna-down position to keep the antenna from poking you. Each version is $19.95.



The PowerPort VX-5 Radio Glove is a quality pouch designed to protect your radio and address some of the shortcomings of standard pouches or belt clips. The designs run from the classic Radio Glove™ (pictured here)to the Radio Badge for your lapel, the Pocket Pro for your shirt pocket, and the Radio Holster, which slips on your belt. (Photo from the PowerPort website)

Contact Cutting Edge Enterprises, 1803 Mission Street, Suite PMB-546, Santa Cruz, CA 95060 (1-800-206-0115; e-mail: <info@powerportstore.com>; <http://www.powerportstore.com>).

Antennas and Accessories

Updated Catalogs from Mosley. Two updated antenna catalogs are offered by Mosley Electronics, Inc. One of the Mosley catalogs describes the firm's TA, MP, TW, CL, S, RV, MD, and MINI Series HF multiband amateur beam antennas. Covered are primarily the classic beams, including the original TA-33 and TA-34 trap multibanders, along with conversion and add-on kits. There also are several new variations, notably the new MINI series, which is promoted for space-challenged amateurs. The other catalog describes the heavy-duty, premium-quality, high-end PRO-Series HF multiband trap beams that are the envy of many "big guns."

A flyer describing still other antennas and some new additions accompanies the catalogs. For catalogs or questions, contact Mosley Electronics, Inc., 1325 Style Master Drive, Union, MO 63084 (1-800-325-4016; e-mail: <mosley@mosley-electronics.com>;. web: <http://www.mosley-electronics.com>).

Portable and Mobile Goodies

Stealth Antennas by HA5CMG/VE7BOC. Charlie Gyenes, HA5CMG/VE7BOC, offers an impressive line of fifth-generation, high-performance, HF mobile antennas—the "Stealth" series.

One of the latest in the product line is the Stealth II™ Series HF Mobile Antennas. These are center-loaded, motorized, and tunable over a wide range: from 6 through 40 meters for the Stealth II-2.5, and from 10 through 80 meters for the Stealth II-3 and Stealth II-4. The antennas all handle 1 KW, with the Stealth II-3 model handling 2 KW.

The Stealth II series antennas are computer modeled for optimum radiation efficiency, and make use of coils and wires that are either silver, gold, or red enamel coated. They employ a quality polycarbonate coil housing, with the coil embedded for shape and rigidity; premium hardware is used. The Stealth II antennas are "SAM ready," and they include the KO6YD "SAM" motor controller. Prices range from $395 to $550, depending on model.

For more information, contact Charlie Gyenes, HA5CMG/VE7BOC, 21085 Cielo Vista Way, Wildomar, CA 92595 (909-674-4862; e-mail: <cmgyenes@aol.com>). You'll find full antenna details on Charlie's website at <http://www.qth.com/stealthantennas>.

Software and Computers

GoSearch from K1XN. John Shelton, K1XN, publishes The Golist, an impressive QSL manager list used by many

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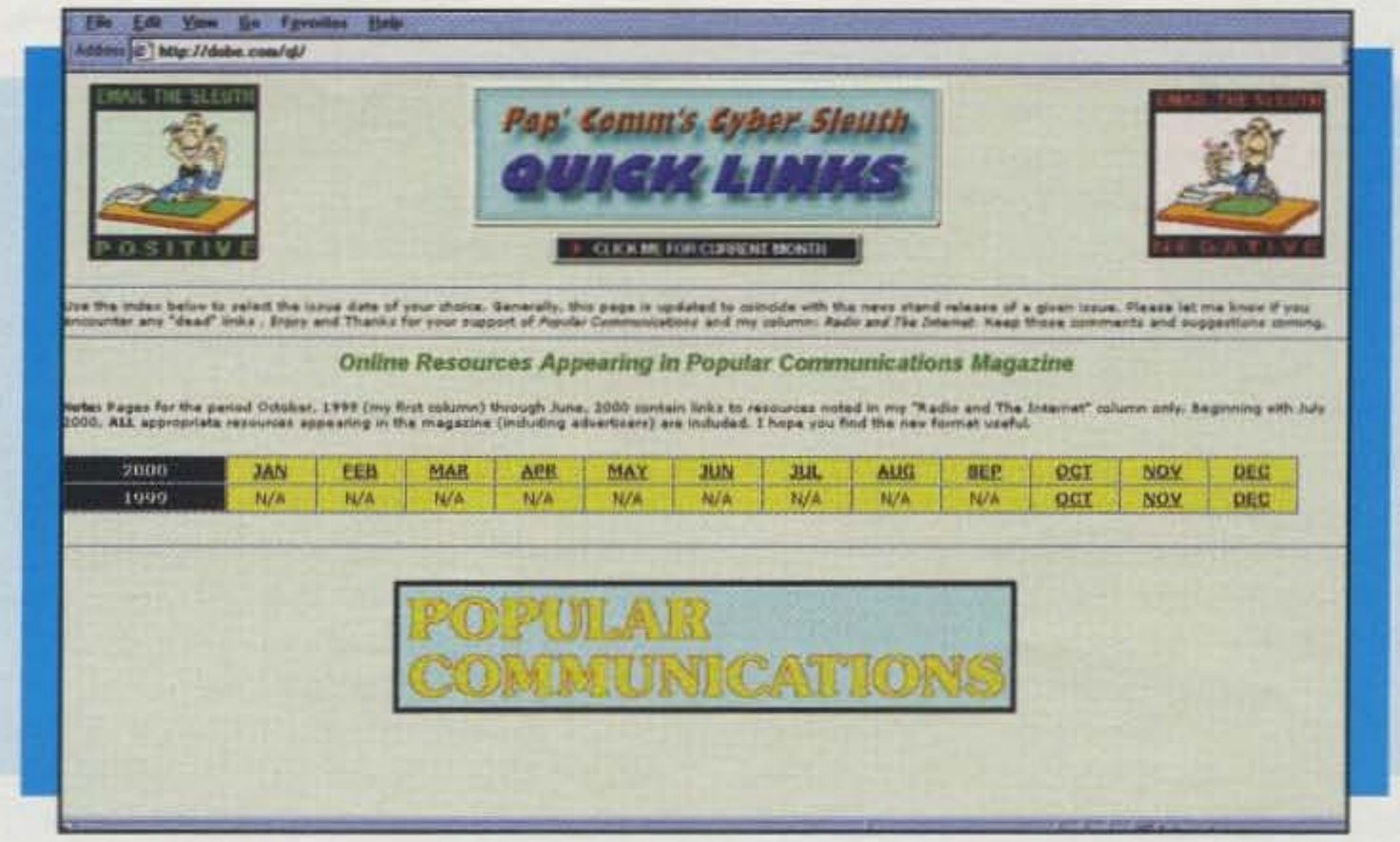

Fig. 1– Pop'Comm colleague Eric Force has made things a great deal easier for readers of his monthly "Radio & the Internet" column with his new Cyber Sleuth's Quick Links Page. The Quick Links Page lists all the internet URLs appearing in the column. You can check out Eric's page at <http://www.dobe.com/ql>.

top DXers worldwide. John's slogan is "The Golist is not the largest database, but it is the most accurate." Recently, he introduced a new Windows program, GoSearch, to search The Golist Online Database for the current QSL routes of DX stations on the air.

GoSearch is a small program that resides in a corner of your screen when active, and it rests on your taskbar when idle. You enter the DX callsign in the search box and the program launches your Internet browser to search The Golist Online Database for your query; it then displays the results. Designed for Windows®3.1, 95/98, and NT, the new program assists the DXer using a logging program without a Golist interface.

GoSearch is "free" to the user, allowing a limited number of no-charge online lookups. If you purchase and register the $24 program, you'll receive a one-year subscription of unlimited lookups on the online database.

For more information, contact John Shelton, K1XN, at The Golist, PO Box 3071, Paris, TN 38242 (901-641-0109; e-mail: <golist@golist.net>; web: <http://www.golist.net>). Several other Golist products are described in detail on The Golist website.

Updated NuTest for Windows. In December 1995 we highlighted a very

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capable Windows-based Morse code practice program, NuMorse, by Tony Lacy, G4AUD. The shareware program had many excellent features for code study and practice. Tony later introduced a Windows-based exam preparation program, NuTest, featured in February 1997 and December 1998. Its purpose was to help people practice for the FCC written exams at all levels.

Recently, Tony advised that he had updated NuTest to Version 1.7. It's a full-featured teaching program to get you through the FCC written theory tests at any level from Technician to Extra. It contains the actual question pools as issued by the ARRL/Volunteer Examiner Coordinator, for use after April 15, 2000, when the license classes and requirements were revamped.

NuTest generates on-screen tests as well as printed tests identical to the real thing. A special feature is a file of complete explanations for every single question, as well as links to files of FCC Part 97 regulations, RF exposure information, and useful math formulas. To help motivate you, NuTest will grade your answers and log your scores for review in graphical form.

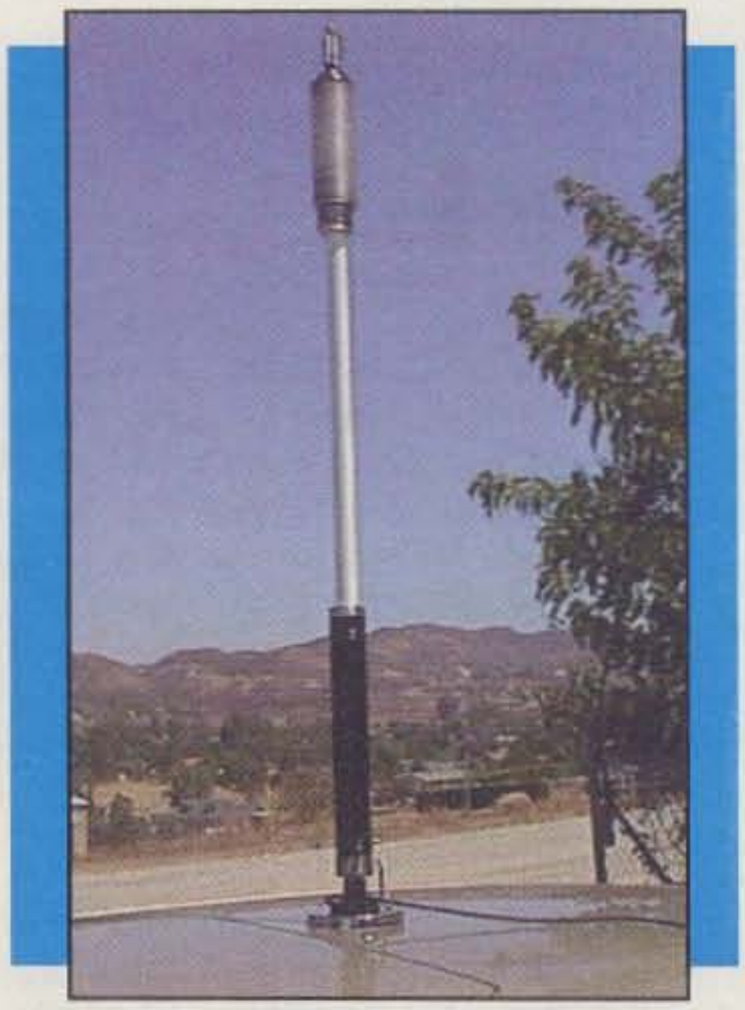
A free NuTest evaluation version is available for download. Prices vary from $14.95 for a single license class version, up to $29.95 for a version that will take you from Technician class through to Extra class.

For details, contact A. Lacy, G4AUD, at Nu-Ware, Llanoris, Llanerfyl, Welshpool, Powys, SY21 0EP United Kingdom (telephone [+44] 1938 820496; e-mail: <Tony.Lacy@Nu-Ware.com>; on the web: <http://www.btinternet. com/~tony.lacy>). *Note:* Toll-free ordering in the U.S. is available at 1-800-699-6395.

WLog2000. Frank Borsa, HB9OAB, offers an interesting software logging package, Wlog2000. He bills it as a "professional amateur radio log for OM, CB, SWL, [and] BCL" use under Windows 95/98/2000/NT.

While we haven't seen the program in operation, Frank's website lists a number of advanced features. These include a fast and easy-to-use logbook; simple configuration; a special, high-speed contest input; full award features; immediate, real-time statistics; several advanced, real-time DX Cluster features; advanced searching and editing of QSOs; world map; rotor control compatibility; long- or short-path antenna directions; QSL and label printing; and much more. The program also features a full trial via the internet, an internet home page, e-mail support, and a mailing list with tips, tricks, and news.

For more information, contact Frank Borsa, C.M.C. - CP127, 6505 Bellinzona 5, Switzerland (+41-91-835.56.51; e-mail: <wlog2000@hotmail.com>;. on the web: <http://start.at/wlog>. The WLog2000 website has extensive program details and views, as well as the ability for you to download a trial version of the program.



Charlie Gyenes, HA5CMG/VE7BOC, offers a line of high-performance "Stealth" HF mobile antennas. Among the latest in the line is the Stealth II ™ Series, one of which is shown here. Several center-loaded designs are available that are tunable from 6 through 40 meters. The Stealth II antennas handle 1 KW or more. (Photo from the HA5CMG/VE7BOC Stealth Antennas website)

New on the Net

Pop'Comm's Cyber Sleuth Quick Links. Our colleague Eric Force writes a very interesting monthly "Radio & the Internet" column in *Popular Communications,* a *CQ* sister publication. I re-

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Fig. 2– Now there's a specialized site just for us—HamBidder.com. It challenges amateurs to "put their money where their mouse is." Here you can list items free at what reportedly is the internet's only major auction site exclusively for and by hams. The HamBidder.com Online Ham Radio Auction site is operated by Amateur Radio Trader magazine. Check out the website at <http://www.HamBidder.com>.

ceive *Pop'Comm,* and I must confess that each month I open his column first. About five minutes after that I rush to check the internet sites and other online resources Eric lists.

Now Eric has made things a great deal easier for readers. He's introduced the Cyber Sleuth's Quick Links Page, which means you no longer have to manually type in the URLs (internet addresses) that appear each month. The Quick Links Page lists all the URLs appearing in the column, both present and past, that are waiting for your mouse clicks.

You can check out Eric's page at <http://www.dobe.com/ql>. It presents an index from which you can select the issue date of your choice. Generally, the page is updated to coincide with the newsstand release of a given issue. Eric asks that you let him know if you encounter any "dead" links. You can e-mail him at <eforce@cybernet.net>.

HamBidder.com. It seems as if just about everyone is getting into the online auction scene today. They're buying and selling practically everything under the sun on eBay and on other online auction sites. Now there's a specialized site just for us—HamBidder.com. It squarely challenges amateurs to "put their money where their mouse is."

Every day, all day long, you can list items free at HamBidder.com, which reportedly is the internet's only major auction site exclusively for and by hams. The HamBidder.com Online Ham Radio Auction Site is operated by *Amateur Radio Trader* magazine.

HamBidder.com features convenient searches, new items, upcoming auctions, and more. The site features easy, step-by-step buying and selling instructions, rules of the house, etc. Listing categories are broken down into radios, amps/preamps, antennas/towers, digital, computers, antique radios, and general. When your items sell, you pay a small fee (which is 3 percent, with a minimum of $3).

Contact HamBidder.com, c/o *Amateur Radio Trader,* P.O. Box 509, Crossville, TN 38557 (1-800-774-2623; e-mail: <webmaster@hambidder.com>; web: <http://www.hambidder.com>). The *Amateur Radio Trader* site is at <http://www.amradiotrader.com>.

From the Bookshelf

New Book from The Radio Works. For many years we have noted the growth of Jim Thompson, W4THU's firm, The Radio Works, the motto of which is "where ham radio is a contact sport." Jim offers a variety of high-performance HF wire antenna systems and high-power baluns, plus a full range of antenna components. Happily, Jim says he's busier than ever at The Radio Works. It even looks like 2000 will be another record-breaking year for him.

Jim usually has several new antennas and antenna accessories in the works, but this time we want to mention his first book. The title is a real mouthful: *Frequently Asked Questions About Antenna Systems and Baluns Plus Exploring Popular Antenna Myths... and the Problem with Inverted-V Antennas!* Jim's new, 120-page book tries to answer some very important antenna questions. At the same time, it seeks to dispel a number of antenna myths. In his book Jim is not beyond poking fun at jealously-held concepts that don't quite hold up under close scrutiny. At the heart of the book are questions that many hams ask over and over again. The new opus is $10.95 plus $3 s&h. (Jim says he's working on two more books; if all goes well, he hopes to have at least one of them to introduce at Dayton 2001.)

If you're a wire antenna fan, check out The Radio Works catalog. You can peruse the online catalog at Jim's website; and the fat (about 80-page) paper General Catalog is still available and free for the asking via bulk mail (in the U.S.). For faster delivery, send $2; copies to Canada are $5 U.S. and to all other countries $8. Contact The Radio Works, P.O. Box 6159, Portsmouth, VA 23703 (1-800-280-8327; e-mail: <jim@radioworks.com>; web: <http://www.radioworks.com>).

We Get Letters

Once again we're just about out of space in this month's "What's New" column. Before wrapping things up this time around, however, we would like to acknowledge some of the good folks who corresponded with us in recent months. A tip of the W8FX hat goes to Bob Hall, KE4BFU; Andy Smith, KK7AC; Lee Wical, KH6BZF; Buck Rogers, K4ABT; Marshall Emm, N1FN; and Andrea Zacek.

So, gang, keep the cards, letters, and e-mails coming, and let us know what new stuff you'd like to see in your "What's New" column. We'll try our best to accommodate your wishes.

Wrap-Up

That's all for this time, gang. Next time, more "What's New." See you then.

Overheard: With respect to my venerable radio junkbox, I've found that I always quickly and easily find something I've misplaced in it when I don't need it anymore!

73, Karl, W8FX

Digital Wireless

Packet Radio and Beyond

BY STEVE STROH, N8GNJ

A Visit to PacComm Packet Radio Systems

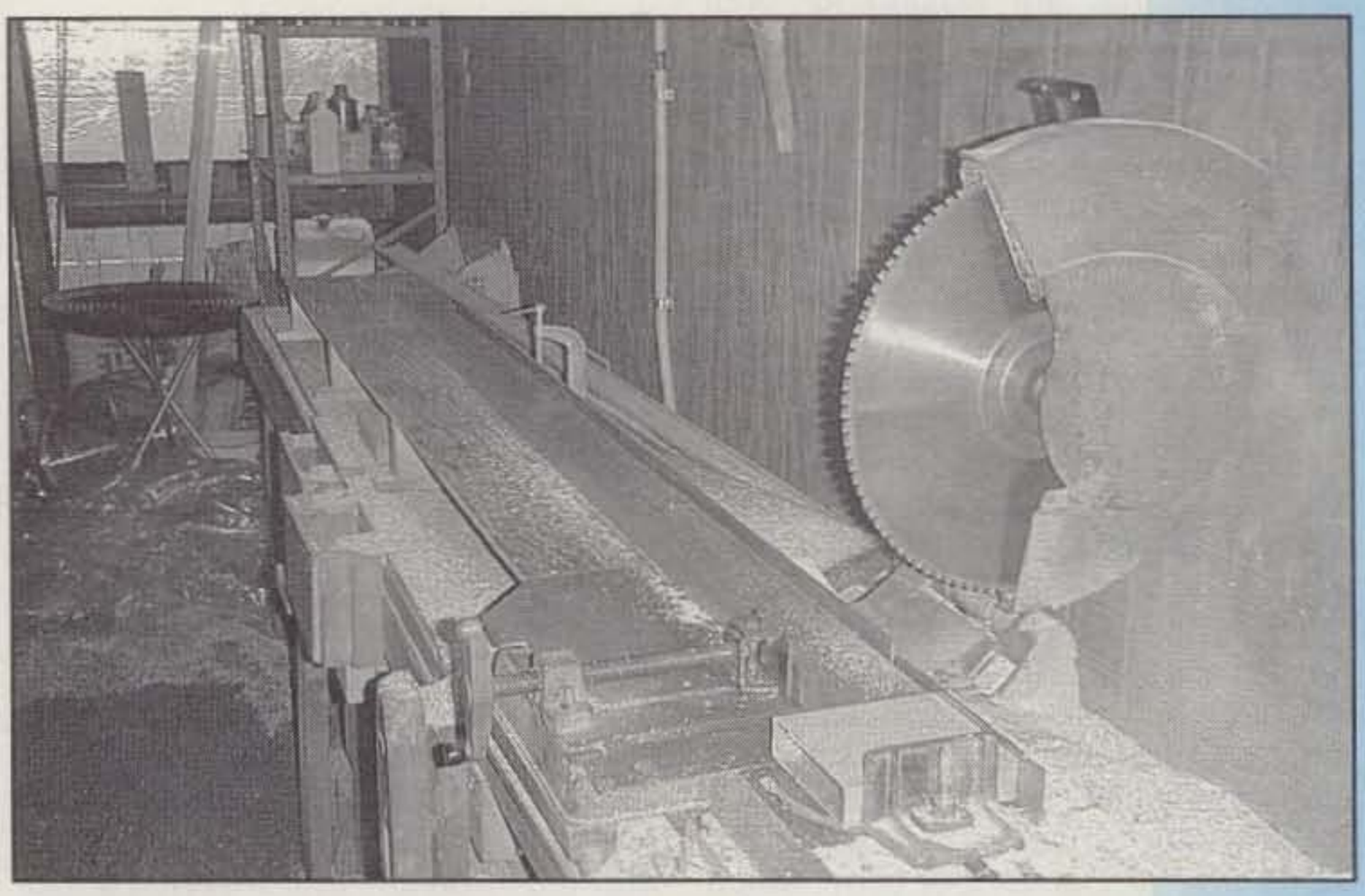
During a recent visit to the Tampa, Florida area, I was lucky enough to have some time available. I had always wanted to visit PacComm, located in Tampa. I called ahead to ask if a visit was okay, and spoke to the company's vice-president Linda Reedy, who graciously invited me to visit. PacComm was one of the pioneers of the "Packet Radio Revolution," and I thought that sharing some of my impressions from the visit would be interesting to the readers of this column.

PacComm Packet Radio Systems is housed in a conventional-looking industrial building near the Tampa airport. The only indication of something unusual is the attached tower and antennas, the shattered main monopole antenna a mute testament to the fact that Florida gets a *lot* of lightning strikes.

Inside, it's immediately obvious that this is an interesting place for techies. For example, Linda's office houses PacComm's "museum"—a collection of examples of most of the equipment that PacComm has made over the years. Linda's personal favorite "museum piece" is the "Sprint" controller, which was PacComm's first "next generation" packet controller. Unfortunately for PacComm, Sprint (the telephone company) heard of PacComm's Sprint and threatened legal action for potentially infringing on Sprint's corporate name. PacComm promptly changed the name of the product to "Spirit," and the Spirit product line has been very successful for PacComm.

PacComm was founded by Gwyn Reedy, W1BEL, and his wife Linda in approximately 1984. The genesis of PacComm was Gwyn and Linda reselling TAPR TNC-2 kits out of their home and at hamfests, basically at cost. Gwyn had some ideas about derivatives of the TNC-2 and founded PacComm while he was still in the military service. Linda kept PacComm going through a rough first few years, with Gwyn unable to devote his full attention to it. As soon as Gwyn's military obligations were completed and he could turn his full attention to PacComm, the company began to thrive, producing the PacComm TNC-200 clone of the TNC-2. PacComm was one of the few to purchase a full source code license for the TNC-2 firmware, and the PacComm firmware base has been expanded and updated considerably.

Alan Alfaro runs PacComm's service department.



PacComm's infamous chop saw, used for cutting extrusions to the proper length to make cabinets for many PacComm products.

PacComm's business is now approximately 75 percent commercial and 25 percent amateur radio. Much of the firm's revenue is derived from long-term contracts with customers that have very specialized requirements (quite often, military and municipal governments) to

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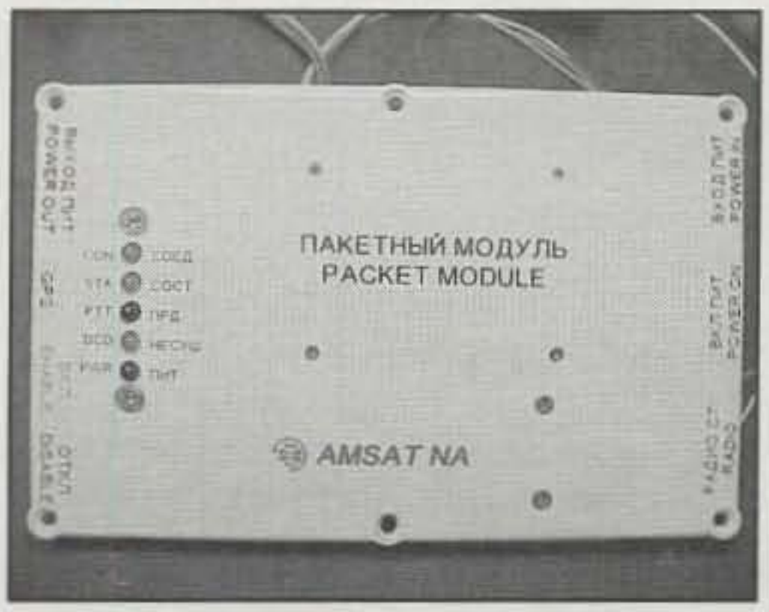
e-mail: <n8gnj@cq-amateur-radio.com>

Jim Weeks heads up PacComm's Engineering Department and handles computer-aided design, prototyping, and documentation.

Juan assembles circuit boards—many, many circuit boards.



PacComm-developed packet radio controller for use on the MIR space station. (Photo courtesy Jim Weeks)

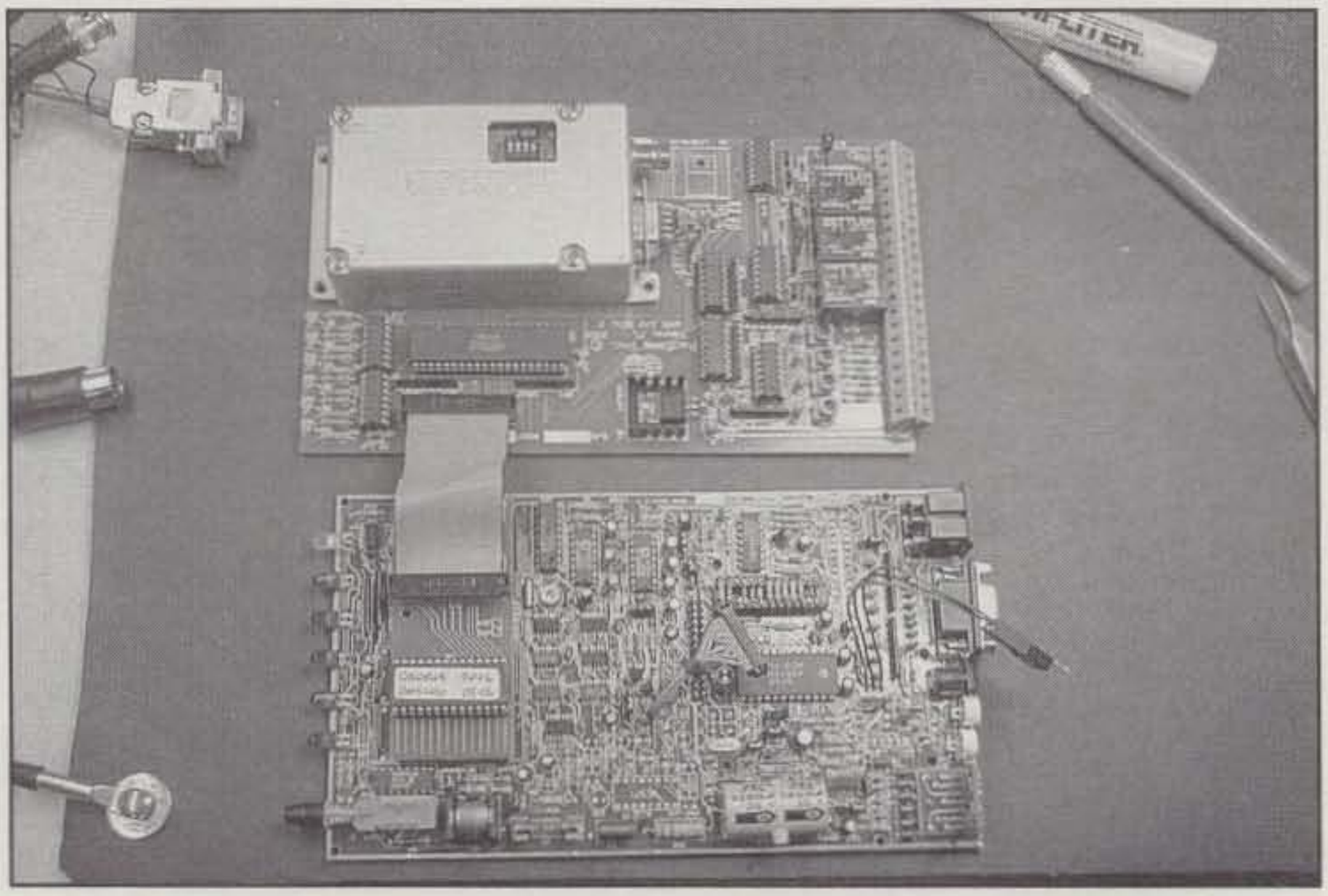
Some of the many older units in PacComm's "museum."

interface two-way radio equipment with computers. Often the computer systems are highly specialized and firmware has to be modified to specifically match the specialized computer hardware. Other requirements are for highly miniaturized digital controllers. I was shown literally dozens of "variations on a theme" of what is basically a TNC. One of the most amusing units I was shown was a PacComm 9600 bps modem for a particular model of a two-way radio, which already *had* a built-in 9600 bps modem. It was explained that the built-in 9600 bps modem simply was not very good, and the PacComm 9600 baud modem worked much better, so the radio owner instructed PacComm to simply bypass the built-in modem and install their unit.

One of the most famous projects that PacComm has produced is the Packet Module made for use by the cosmonauts and astronauts aboard the MIR space station. A product line that is not nearly so well known is PacComm's "Intelligent Border Marker System" that it developed for the US military for use in Bosnia. Basically, IBMS is a self-contained system—incorporating batteries, radios, GPS receiver, packet controller, and antenna assembly—that is dropped out of a helicopter, landing on an attached steel stake. More details on the IBMS are at <http://www.paccomm.com/paccom1a.html>.

PacComm's niche in the wireless communications marketplace makes it clear that despite startling advances in wireless communications, much of it is based on TCP/IP and the pronunciations of "IP Everywhere" (of which I'm guilty), much of the work of wireless is still done with two-way radio technology, and IP for that application is overkill. For example, many of PacComm's projects involve integrating GPS technology into an existing radio system, but in a much simpler manner than Automatic Position Reporting System (APRS). The police department of one Latin American city needed to be able to see on a map the realtime position of their police cars, and wanted to try to "piggyback" that information on their existing, extensive two- way radio system. PacComm developed an internal packet controller

PacComm Packet Radio Systems, Tampa, Florida.



A typical packet controller with Maxon SD125 radio (case modified for easy access to the synthesizer control switches).

(such units are considerably more advanced; thus the label "TNC" isn't very accurate) that integrates a GPS receiver and the necessary modifications for the radio. PacComm trained the department's personnel to install the units, and now the police department has location capability at a small fraction of the cost of upgrading every radio.

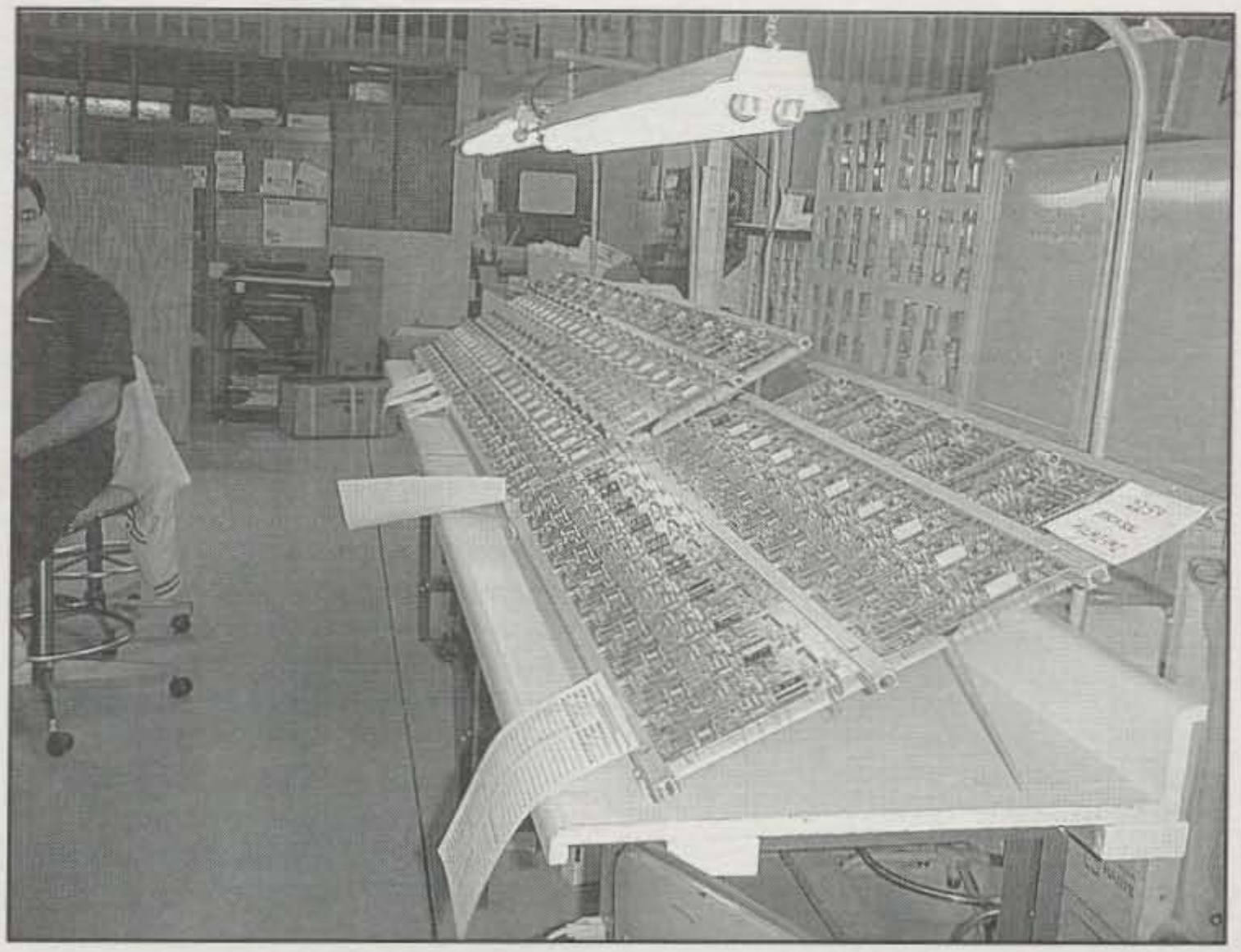
Several years ago, when the amateur radio market took a downturn, PacComm made a hard choice to de-emphasize amateur radio sales in favor of commercial contacts. Realistically, selling TNCs at between $100 and $200 simply was not very lucrative, when the extensive marketing and support operations, and especially the personnel to staff them, were factored in. PacComm is still very much in the amateur radio market, but now relies on its web page (<www.paccomm.com>) and occasional catalog mailings to market to amateur radio operators.

PacComm has a staff of approximately ten people. The number varies depending on whether a new project is being developed or a large order needs some extra help to be completed. One of the areas that was not cut back was the service department, ably manned by Alan Alfaro. I was surprised to see that not only are PacComm products more than ten years old being serviced, but so are products for long-obsolete computers such as the Commodore VIC-20 and Commodore C-64.

PacComm does the vast majority of its production in-house, beginning from the printed-circuit board, and proceeding through circuit-board assembly, soldering, and final assembly. The firm's products are claimed to be 100% produced in the USA. Each unit produced is matched to a specific requirement by a specific customer, and each is a long-term contract, requiring PacComm to supply units as needed, provide repair services, and also to stock sufficient parts to be able to continue supplying units for a number of years. Much of PacComm's floor space is devoted to parts storage specifically to satisfy this requirement. One of the highlights of visiting PacComm's production facilities was seeing the infamous "chop saw," which is used to cut the extruded cabinets used in many of PacComm's products to the right length for each product. For example, enclosures for the Spirit product line and the TNC-200 are merely different-length cuts from a very long piece of extrusion.

It was surprising to me that PacComm's WA4DSY 56K modems are selling reasonably well, despite there being little domestic market for them. Linda explained that they are being used in overseas markets, mostly in commercial applications, with locally purchased transverters. To provide a computer I/O solution for the WA4DSY modem, PacComm developed a derivative of their Spirit packet controller called the "Spirit PAD," which is able to keep up with the throughput of the WA4DSY modem. Unfortunately, PacComm's deal to manufacture other next-generation packet radio/networking products under license from Gracilis simply didn't develop due to lack of communication and support from Gracilis. That was unfortunate, as the Gracilis PackeTen router likely could still find numerous applications, despite a design that is more than five years old.

PacComm is developing new products. It is considering re-introducing an old product line—the DR-200, which is a dual-port digipeater specifically designed for harsh environmental and RF conditions—to possibly begin intruding the concept of backbones into extensive APRS digipeater networks. The company is developing several products that incorporate spread-spectrum radios.



Long-term production runs at PacComm.

One of the most interesting "not quite a product" items that I saw during my visit was a Maxon SD125U radio. The SD125U is a small, relatively inexpensive data radio that covers amateur radio UHF frequencies, either 2 or 5 watts, and is synthesized. PacComm uses the SD125U, and the VHF version (SD125V, which unfortunately does not cover 144–148 MHz), in a number of its products, and has had very good experiences with them—after a few minor modifications, of course! I mentioned that there well may be a reasonable market for such a radio, and if there is sufficient interest expressed to PacComm, they may offer it as a product.

All in all, my brief visit was a fascinating glimpse at PacComm's operations. I'd like to very much thank Linda Reedy for allowing *CQ* readers "a look around" at the birthplace of so much packet radio technology that we now take for granted.

73, Steve, N8GNJ

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VHF Plus

BY JOE LYNCH, N6CL

All About The World Above HF

Phase 3D Launched

The very long-awaited, often-postponed Phase 3D satellite was successfully launched on 16 November 2000. The following is courtesy of the AMSAT News Service (ANS):

"It was a textbook launch," said Peter Guelzow, DB2OS, "from the first minute of flight, until P3D separated from the Ariane 5 launch vehicle, all received telemetry indicates the launch went perfectly and our satellite appears to be in very good health."

AMSAT-NA President Robin Haighton, VE3FRH, welcomed the news of the launch, noting that "the design, building, and financing of P3D by international volunteers is a great achievement."

Immediate AMSAT-NA past President Keith Baker, KB1SF, told ANS that he was "delighted" by the news of the Phase 3D launch. "Obviously this is a big thrill for all of us who have spent the better part of our lives over the past ten years bringing the satellite to fruition. I have no doubt that today will be regarded as one of the greatest days in the history of amateur radio."

ANS also received word from AMSAT-NA Board of Directors Chairman (and past AMSAT-NA President) Bill Tynan, W3XO. "I can't begin to tell you how happy I am to see P3D in orbit," said Tynan. "As I followed the launch sequence, I thought of the many people who have been involved with this project from the very beginning and how pleased everyone must be to see the reward of such hard work."

From its launch, there was much to do to get the satellite ready for operation. Hopefully, by the time you read this, QSOs will already have been made. For additional information and bulletins from AMSAT, check out their URL at <www.amsat.org>. AMSAT is the official source of information on the Phase 3D satellite. For an extensive launch log, go to the URL <http://spaceflightnow.com/ariane/v135/status.html>. CQ also maintaineda ham radio focused log on its website at <http://www.cq-amateur-radio.com>.

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(phone 918-627-6625; fax 918-835-9785)
e-mail: <n6cl@cq-amateur-radio.com>

VHF Plus Calendar

Jan. 2	First quarter Moon.
Jan. 3	*Quads* meteor shower predicted peak. See text for details.
Jan. 7	Moderate EME conditions.
Jan. 9	Full Moon and highest declination.
Jan. 11	Moon Perigee.
Jan. 14	Very good EME conditions.
Jan. 16	Last quarter Moon.
Jan. 20-22	ARRL Jan. VHF QSO Party. See text for details.
Jan. 21	Very poor EME conditions.
Jan. 22	Lowest Moon declination.
Jan. 24	New Moon.
Jan. 26	Moon Apogee.
Jan. 28	Moderate EME conditions.
Jan. 31	First quarter Moon.

• *EME conditions courtesy W5LUU*

ARISS Operational

This past November witnessed another amateur radio space success—the successful launch of a Russian Soyuz rocket that carried the all-ham International Space Station Expedition 1 crew on October 31 from the Baikonur Cosmodrome in Kazakhstan. On board the Soyuz were US astronaut and Expedition 1 Commander William "Shep" Shepherd, KD5GSL, and Russian cosmonauts Yuri Gidzenko and Sergei Krikalev, U5MIR. The crew will spend four months aboard the ISS.

Amateur radio operation from the ISS was expected to debut by mid-December. Crew members may be using their personal callsigns or one of the "club station" callsigns issued for ISS use—NA1SS, RZ3DZR, or DLØISS.

According to Will Marchant, KC6ROL, the International Space Station crew has completed installation of the amateur radio hardware in the Functional Cargo Block. The amateur radio on the International Space Station—or ARISS—initial station gear permits operation on 2 meters—FM voice and packet. Expected operating frequencies are: Worldwide downlink for voice and packet, 145.80 MHz: worldwide packet uplink, 145.99 MHz; Region 1 (Europe) voice uplink: 145.20 MHz; Region 2 and 3 voice uplink, 144.49 MHz.

With the successful execution of engineering tests, the ARISS project has passed a significant milestone. The initial two passes were tested at the Gagarin Cosmonaut Training Center (GCTC) ham shack R3K in Star City near Moscow. Control operators were Sergej Samburov, RV3DR, and Vladimir Zagainov, UA3DKR. Sergej is the Russian delegate to the ARISS team.

Subsequent tests at the NN1SS station at the Goddard Space Flight Center (Greenbelt, MD) and the W5RRR station at Johnson Space Center (Houston, TX) were equally successful.

For ARISS information and updates, visit the ARISS web site, <http://ariss.gsfc.nasa.gov>.

New 145 GHz Record Set

The following is from the *ARRL Letter:* "A new North American claimed record at 145 GHz was set November 6 when Brian Justin, WA1ZMS/4, and Geep Howell, WA4RTS/4, established two-way contact over a path of 34 km (21.1 miles). Justin reports that the CW signals were weak but copiable. The transmitter power on each end was around 5 mW. ICOM R-7000 receivers were used for IFs. WA1ZMS was on the Blue Ridge Parkway in FM07fm. WA4RTS was in Lynchburg, Virginia, in FM07ji. 'No receive margin was to be had on the WA4RTS end, so we reached the limit of what we can do for now with the exception of weather conditions,' Justin said." Information supplied to the *ARRL Letter* by Brian Justin, WA4ZMS/4.

New 24 GHz Record Set

The following is from Gary Lauterbach, AD6FP, and Ron Smith, K6GZA, via "Feed Point": "During the second Saturday of the 2000 10 GHz contest K6GZA and AD6FP completed a 24 GHz contact from Mt. Oas in northern California to Frazier in southern California. The calculated distance from CM97hrn to DM04ms of 375 km (233 miles) is believed to be a new North American record. The exact distance from 121º 22' 26"W, 37º 30' 31"N to 8º 58 '08" W, 34º 46' 27"N is calculated as 372.68 km (231.57 miles).

"The contact at 10:45 am PST on Saturday, September 16, 2000 was completed on SSB with signals peak-

ing to S7 on the Frazier end and S5 on the Oso end of the path. At the time conditions on 10 GHz over the same path were excellent, with S9+30 signal levels. Signal levels were good enough for K6GZA and AD6FP to converse for several minutes before each went back to working other stations in the contest.

"AD6FP on Frazier was using 500 mw and a 1.22 meter offset fed dish. The AD6FP receive chain has a 4 dB NF with all LOs being locked to a rubidium standard. K6GZA Mt. Oso was using 100 mw to a 4 foot prime focus dish. The K6GZA receive chain has a 5 dB NF with LOs locked to an OCXO that is kept continuously powered. The accuracy and stability of the LOs at each end enabled signals to be quickly located. Dish pointing error was also minimized using two techniques: AD6FP runs a dual band feed for 10 and 24 GHz allowing the dish to be peaked up at 10 GHz before moving to 24 GHz. K6GZA uses a novel tripod mechanism that allows the 10 GHz radio to be replaced with the 24 GHz radio without disturbing the tripod setting."

6 M Propagation Good, But...

Propagation for 6 meters this past late October and early November was good on certain days. However, it was not up to what those who were around for the peak of the last cycle experienced. Helping create an incentive to get on were operations from Kingman Reef (K5K), Palmyra Island (KH6ND/KH5), Clipperton (FOØAAA), and the following DXpeditions of Arliss Thompson, W7XU, and Chris Gare, G3WOS, described below.

W7XU DXpedition Summaries. During late October and early November Arliss Thompson, W7XU, traveled to French Guiana and Guyana for a brief but fruitful DXpedition. The following is a summary of his operations:

"I arrived in Cayenne, French Guiana, late on the 26th of October. It was a long flight from Miami to Cayenne, with stops in Haiti, Guadeloupe, and Martinique. I did not get on the air that night, but was active the next night from the Mecure Atlantis hotel in Kourou. Although I had only a wire dipole while at that location, I was able to work about 70 Europeans as well as stations in the Caribbean and South America during the evening of the 27th and the morning of the 28th.

"During the day on October 28th, thanks to Marc, FY5LS, and some other locals, I was able to set up at the FY5KE club station in Kourou. The other operators and I had to leave the station early, however, because of a rocket launch scheduled for that night at the nearby European Space Agency launch pad. I was back early the next morning, though, and enjoyed a fantastic 6 m opening to Europe. The only problem was that the QRM was so intense that it was very difficult at times for me to pick calls out of the pile-up.

"My equipment consisted of an ICOM 736 running 100 watts on 6 m. The 6m antenna I used at FY5KE was a 5-element Yagi at (a wild guess) about 40 feet. I didn't operate on any of the HFf bands while visiting FY5KE because other club members were active in the CQ WW SSB Contest and 6 m kept me quite busy anyway.

"Countries worked included: CN, CT, DL, E30, EH, EH6, EH8, EI, F, G, GW, HB, HC8, I, J8, JY, KP4, LX, LZ, OE, OK, OM, ON, PA, S5, SP, SV, TI, UT, VE, VK, VK9C, VP2E, W, YO, YS, YU, YV, ZA, Z3, 5B, 9A, and 9H. I made approximately 570 QSOs, with the largest number (107) being with Italians. All but one of my QSO's were on 6 m.

"I would especially like to thank Marc, FY5LS, as well as the other FY5KE club members for their hospitality and assistance.

"During the afternoon of the 30th I went to the airport near Cayenne, French Guiana in order to catch my plane to Georgetown, Guyana. When I checked in with Air Surinam I was told that my baggage was overweight. I knew that I was right at the maximum permitted by Air France when I left Miami—two checked bags of about 70 lbs. each. But the lady at the Air Surinam desk told me that they only allowed 20 kg total. My carry-on alone weighed that much! Luckily, the lady behind the desk just shook her head, rolled her eyes, mumbled something about Americans, and let me go with no excess baggage charges. Whew!

"I arrived in Georgetown late on the night of the 30th and was dismayed to find that I had been assigned a room on the third floor of the hotel even though I had specifically requested a spot on the top (seventh) floor when I had made my reservation several months before. Much of the next day was spent trying to get my permit to operate in Guyana (difficulties arose because of city-wide power outages) and waiting for a seventh floor room to open up.

"By the end of the day, Mr. Singh of the National Frequency Management Unit (the Guyanese equivalent of the FCC) instructed me to just go ahead and operate and we'd do the paperwork when the power came back on. Fortunately, the hotel came through with a room on the top floor, plus they said I could go on the roof to install my 6 m Yagi. Luckily the hotel had its own generator so the intermittent power outages wouldn't keep me off the air.

"It was well after dark before I was able to move into my new room at the hotel, so I didn't have a chance to to put the Yagi up. I did hang dipoles for 6 and 10 m outside my window, and made some QSOs on 10 after checking 6 m and finding it dead.

"I was up early (0930 UTC) on the morning of the 1st, but conditions on 6 m were marginal to non-existent throughout the day. During the evening I worked some Central and South

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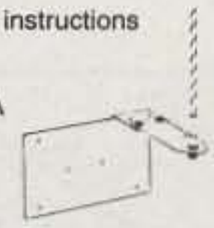
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American stations via backscatter and sporadic-E.

"Getting my Yagi up proved to be a bit of a challenge. The hotel provided me with a ladder that was too short to get from the observation deck to the roof, and it wasn't until the following day that I got a ladder long enough to get on the roof. Once on the roof, however, I found that the situation had changed from the photos I had seen; there wasn't room to put up my 40 foot boom Yagi and rotate it because of the commercial antennas and other obstructions that were present. So I had to compromise and only put up the rear half of the antenna.

"Unlike French Guiana, where my best openings were to Europe, conditions in Guyana favored the U.S. Most mornings I would work a few Europeans beginning around 1200 UTC, and then typically start hearing stateside stations around 1300 UTC. By 1600 UTC the W/VE stations were usually gone, and I would listen for stations in the Indian Ocean and SE Asia.

"Countries I worked from Georgetown on 6 m included: A4, CE, CT, CX, EH, EH8, EH9, F, FY, HC, HK, HP, I, J8, JY, LU, PY, S5, TI, V3, VE, VK9C, VP2M, VQ9, W, XE, YB, YS, YV, ZD8, ZF, ZP, 4X, 5B, and 9H. I was able to work approximately 560 North American stations and about 130 DX stations on 6, plus several hundred on 10 m."

For more information on Arliss' trip, check out his URL at <http://www.iw.net/~w7xu>.

Chris Gare, ZD8SIX DXpedition

During early November Chris Gare, G3WOS, made a short DXpedition to Ascension Island. The following, courtesy the UK Six Metre Group, is an excerpt from is very extensive and colorful report. "Unlike my trip to the Falklands in April, I fully expected to get good propagation from Ascension. Bearing in mind its geographic location and my carefully chosen time (at the peak of cycle 23). Propagation has lived up and definitely exceeded anything that I could have hoped for. I have had at least some propagation every day, although two were quieter than the others.

"The propagation had following characteristics: The first two nights produced pure, strong evening TEP to Europe starting at 20:00 on the dot in the evening. There was nothing during daylight hours that I noticed and I was wrongly convincing myself that I wouldn't be seeing any during my stay.

"For the first two nights, the propagation shifted from Europe to the Caribbean at around 22:30 in the late evening (although European signals didn't die away).

Sunday, onwards I did not see any early evening European TEP, but the late evening Caribbean TEP occurred every evening while on the island. Propagation shifted strongly to morning TEP starting at about 11:00 and dying at 13:00. On these days I did not see any early evening TEP to Europe.

"On two nights, the TEP turned into long-path openings that lasted for over two hours. This surprised me, as I thought that long-path openings were transient in nature. Signals were strong and had no flutter of any sort, almost like Es openings.

"I am forced to wonder why this major shift from early evening to morning TEP happened? What triggered it? I guess it happens all the time. Late-night long-path openings seemed to be independent of whether there was either a morning or early evening TEP opening earlier. When I was experiencing the long-path openings, Jose, EH7KW, and Nick, 5B4FL, experienced them as well. Were they experiencing a weaker version of what I was hearing? It was certainly different as neither heard FO or BV."

Countries Chris worked included: 3C, GD, OK, ZP, 4X, GI, ON, 5B4, GU, PA, 5X, GW, PY, 8R, HB, S5, 9H, HI8, SV, 9Y4, HK, SV9, BV, HP, T7, CE, I, TA, CT, J87, TI, CT3, JA, TR8, CX, JY, V44, D, KP2, VP2M, EH, KP3, VP2A, EH8, KP4, YO, EI, LU, YU, F, LX, YV, FM, LZ, ZA, FO, OD, ZD8, G, OE, ZF, and 9A.

For a complete report on Chris' trip, check out his URL at <http://www.uksmg.org/ascension-home.htm>.

First EA-Cuba 6 meter QSOs

During a brief opening on 7 November, Arnie Coro, CO2KK, established the first ever two-way contact between EH7 and CO2, then later between EH9 and CO2. The first QSO was on CW, with EH7GTF. The first ever SSB contact was with EH7KW near Sevilla.

SVHFS Conference Call for Papers

The following is from the Southeastern VHF Society: "The Southeastern VHF Society will host its fifth annual conference on April 20–21, 2001 at the Holiday Inn Brentwood, in Nashville, TN. This is the first call for papers to be published in the conference Proceedings. Papers should be submitted to Dick Hanson, K5AND, at 7540 Williamsburg

Dr., Cumming, GA 30041; phone 770-844-7002; fax 770-889-8297; e-mail <k5and@ga.prestige.net> for review. The deadline for submission is February 20, 2001.

"Papers may be hard copy, or preferably, on diskette in MS Word 7 (or later) format. We can also convert Word Perfect files; pictures are best in black and white. Be sure to number figures, graphs, drawings, and pictures so that we can match them with the references in the body of the article.

"More details on guidelines may be viewed on our website at <www.svhfs.org/svhf>."

Current Contests

ARRL VHF Sweepstakes: This annual winter classic takes place from 20–22 January, beginning 1800 UTC 16 January and ending 0300 UTC 18 January. Exchange is your grid square. This is the only VHF contest that features club competition.

The complete rules appear in December 2000 *QST*. Rules, plus log/summary sheets are also available electronically from the League from their home page (<http://www.arrl.org>) via the World Wide Web. As always, send or electronically file your log and summary sheets to the League.

Current Meteor Showers

The *Quads:* The *Quandrantids*, or *Quads*, is a brief, but very active meteor shower. According to OH5IY's meteor-scatter software, the expected peak is around 1040 UTC on 3 January. The actual peak can occur ±3 hours of the predicted peak. The best paths are north-south. Long duration meteors can be expected about 1± hours after the predicted peak. As always, look to 3818 or 3843 kHz in the evening hours for opportunities for schedules.

Piero Moroni, I5TDJ Silent Key

Piero Moroni, I5TDJ, became a Silent Key on 14 November following complications from chemotherapy. Piero had been ill on and off since 1994 and was hospitalized in mid-October because of a reoccurrence of his illness. He was 66.

According to his friends, Piero was a very capable technician, both in theory and in practice. According to one report, he had earned the reputation as an engineer's engineer. An electronic engineer by training, Piero had been licensed since 1952 and on EME since 1975. He was one of the first EMEers on in Italy, operating mainly on 432 MHz. Piero had Elmered a number of would-be EMEers in getting started on that mode, both in his country and abroad.

And Finally...

This month we start a new millennium. It presents us with a blank slate as to what we can and will accomplish during it. As a regular Star Trek fan, I am fascinated by the various fictional technological advancements proffered in the series. Often, I wonder just how long will it be before we actually make such advancements.

We in the weak-signal community are the pioneers in communications in our hobby. We have always been on the cutting edge. This past November we were presented with two opportunities for new cutting-edge communications. There is not as much in the ARISS program at present, but the potential exists for cutting-edge experimentation in the future in that ham shack in the sky. It is up to us in the weak-signal community to imagine, design, and then submit proposals for experiments that can be conducted onboard the ISS.

The Phase 3D satellite presents us with a much different platform but an immediate one. Various experiments can be conducted on an almost daily basis. All we have to limit ourselves is our imagination.

My encouragement to all of us is to go back to work on our cutting-edge technology and develop experiments that will advance our technology. When you do, send me information about your successes and I will be sure to write it up in this, your column.

Until next month in the new millennium...

73, Joe, N6CL

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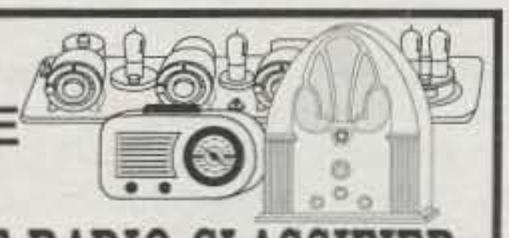

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FLORIDA STATE CONVENTION

Op Ed

BY ROBERT SUDOCK, WB6FDF

One Reader's Opinion

The "Spectrum-Grab Express"

The Summer Olympics in Sydney resulted in the "temporary" loss of parts of 70 cm for Australian hams. But, says the writer, "temporary" changes often become permanent. WB6FDF also offers a prescription for self-preservation.
—W2VU

Sometimes it takes a collision with a stone wall to get my attention. I should have been able to see it. But if I did, all that stone debris would have been thrown back in my direction. "Heresy," some would cry. Because, I'm sad to say, it is the effect the Olympic Games have on radio spectrum.

Early on, "Q-News" reported that the hams in the region of the Sydney games were asked (ordered?) to cease all activity in certain portions of 70 centimeters. In "Q-News" for 24 September 2000, came this realization:

> The Olympics, the communications side of these games may never have been possible were it not for the public spirited attitude of the Amateur Radio operators of the State of New South Wales. The unfortunate thing however is that their willingness to accommodate seems to have cost us part of our shared 70 cm band.

The temporary was becoming permanent. I could have predicted that.

Déjà vu All Over Again?

So how am I the blessed/cursed with this knowledge? I am an engineering manager at a television station in Los Angeles. In 1983, I was part of a group of engineers invited to participate in frequency coordination planning by the American Broadcasting Company (ABC), host broadcaster for the XXIII Olympic Games in Los Angeles.

In our discussions, we were unable to find sufficient spectrum for all the communications requirements that had been requested. The FCC granted Special Temporary Authority (STA) for spectrum utilization on unoccupied (within 280 km of Los Angeles) UHF television channels 14–18 (470–512 MHz). Motorola was willing to modify its commercial equipment to operate in this range. After the Games, all would return to normal.

WRONG! Shortly after the Games ended, the FCC amended Part 2.106, Subpart "B," Table of Frequency Allocations. Note NG66 now states:

> The frequency band 470–512 MHz is allocated for use in the broadcasting and land mobile radio services. In the land mobile services, it is available for assignment in the domestic public, public safety, industrial, and land transportation radio services at, or in the vicinity of, 11 urbanized areas of the United States, as set forth in the following table. Additionally, in the land mobile services, TV channel 16 is available for assignment in the public safety radio services at, or in the vicinity of, Los Angeles. Such use in the land mobile services is subject to the conditions set forth in parts 22 and 90 of this chapter.
>
> **Urbanized Area TV Channels**
> New York, NY-Northeastern New Jersey 14, 15
> Los Angeles, California 14, 20
> Chicago, Illinois - Northwestern Indiana 14, 15
> Philadelphia, Pennsylvania - New Jersey 19, 20
> San Francisco - Oakland, California 16, 17
> Boston, Massachusetts 14, 16
> Washington, D.C. - Maryland-Virginia 17, 18
> Pittsburgh, Pennsylvania 14, 18
> Miami, Florida 14
> Houston, Texas 17
> Dallas, Texas 16

As history has a tendency to repeat itself, the loss of spectrum in New South Wales was, perhaps, inevitable. Was Australia's fate sealed when the International Olympic Committee awarded the 2000 Games to Sydney nearly a decade ago? Obviously, the cause is not the Games themselves, but the needs of those supporting them—more precisely, a huge event held at a number of venues across the landscape, taking months of final preparation and weeks to execute. Unfortunately, the Amateur Radio Service was the victim Down Under. I wonder which services, if any, suffered in Barcelona or Albertville or what the future holds for Salt Lake City and Athens.

I recall that there was some documentation of the number of frequencies we coordinated back in 1984. Unfortunately, that material is back in the dusty archives. But for contemporary comparison, the Democratic National Convention held in Los Angeles last August coordinated and authorized more than 900 requests on frequencies between 26 and 952 MHz, and nearly 150 applications for spectrum between 1.9 and 40.0 GHz. This was concentrated in *one building*, the Staples Center arena.

The television technical trade press reports that the Formula 1 U.S. Grand Prix at the Indianapolis Motor Speedway 22-24 September had requirements for more than 4,000 frequencies! The trend toward more and more wireless grows.

Fallout for Hams

When Amateur Radio shares frequencies with the military, we are not likely spectrum targets. As the military moves to satellite and other exotic modes, though, hams are left without their "armor." I will hazard this prediction: the 70 cm issues of Sydney and Los Angeles will repeat themselves in each new city hosting the Olympics or other event where large contingents of the electronic media gather. It will also make it easier for the communications authorities around the world to make "temporary" reallocations permanent. So the question is, "What can we do?"

Let me tell you that the stone wall prospect is not appealing and serves no useful purpose. Doing nothing is worse. At least you get some exercise running into that stone wall. We must promote the hobby to the outside world by trumpeting the successes of public-service activities such as WICEN *(Australia's amateur radio emergency service — ed.)*, RACES, or Skywarn. Continue amateur radio's outreach with race and parade communications support. We must engage our youth with programs such as JOTA (Jamboree on the Air) or helping science classrooms explore communications by contact with the International Space Station, the Space Shuttle, Mir, or OSCAR. At the very least, we must all support our amateur radio societies and their legislative efforts on our behalf

Listen. Do you hear it? That's not thunder. It's the Spectrum Grab Express. It's picking up speed and it's heading in our direction.

This Op-Ed is reprinted with permission from Australia's "Q-News," the news service of the Wireless Institute of Australia.

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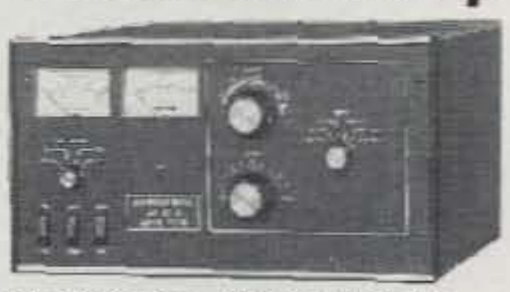

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Awards

BY TED MELINOSKY, K1BV

News Of Certificate And Award Collecting

This month we again cover some of the questions we have received regarding the USA-CA Award, and then move on to more awards from around the world. First, though, is a profile of Jerry Pierce, KI7SN, USA-CA All Counties #1008, September 23, 2000.

I've loved radio for as long as I can remember. I grew up in a rural area of Vancouver, Washington with neighbor kids few and far between. That meant a lot of spare time listening to a little five-tube radio. It was my pride and joy and constant companion. The Lone Ranger, Tom Mix, and The Shadow all came to life in my imagination when my radio was on. I learned a lot listening to that little Zenith, and more when a tube burned out. I simply took a tube from my dad's radio and plugged it in. Did you know that not all tubes are the same? Well, I was in trouble.

Jerry, KI7SN, USA-CA All Counties #1008.

It wasn't until I was finished with 14 years of coaching baseball with four sons that I finally had time to return to radio. Even then my career as a ham began as an attempt to show my youngest son, Steve, that the "old man" wasn't over the hill yet. About this time the No-Code Tech avenue into amateur radio opened and Steve rushed in to pass the test and begin his ham experience. He arrived home beaming with his license and callsign KB7TSO and set my mental wheels in motion. "If the kid can do it without studying, the old man can surely pass with lots of studying."

It was an intellectual pursuit, as I studied hard to uphold the Senior reputation. As I passed one level after another I was greeted with, "How many did you miss?" My answer: "Was I supposed to miss some?"

Eventually I passed the Advanced level before asking myself, "What am I doing? I don't even have a rig yet. How can I be a ham without a radio?"

65 Glebe Road, Spofford, NH 03462-4411
e-mail: <k1bv@cq-amateur-radio.com>

It was then that I was to meet my Elmer, George Wagoner, N7UDT. Fortunately for me, George lives nearby and is the 7th call area awards director for the Century Club. With a fine, old Yaesu 101E purchased from a local ham, I was soon on my way working states. As I was applying for my last Century Club award, George suggested that I had a good start on something called "county hunting." Little did I know what lay ahead.

First, I would have to replace my aging 40 meter dipole with something resonant on 20 meters to reach County Hunter Land. After a look at my checkbook and a trip to the library, I determined that I should homebrew an off-center-fed "Washington Windom." And so it was that "Kisn Radio," or "Sugar Nancy," as I was soon named, began the task of collecting 3076 counties.

At first it was great—20 counties a day, no problem. Even working full time, rushing home from work, and weekends constantly on the radio, the numbers piled up almost as fast as the friends I made on the net. 1000, 2000, and finally 3000 counties and the year 2000 came into view. A very patient wife allowed me the freedom to do this even though she still can't understand why I would want to, or how I can hear the radio with only half the hearing of a normal person. Heavy artillery (Oh, did I love the sound of that 8 inch Howitzer) and a lifetime of skill saw noise have taken their toll. Then with the end in sight, it happened.

By now I was using a nice little Yaesu 840, great for its size as a mobile rig and convenient as a base rig, but it did not like me spinning its dial chasing a DX station and froze solid in its tracks. Luckily, it happened on 80 meters and my VFOs on 20 meters were set on the County Hunter Net frequency and its nearby alternate frequency, 14342. What this meant was that if a needed county was on the net frequency or this alternate, I was in business. If it moved to another frequency, I was out of luck. With about 20 counties to go, it looked really bad. It seemed that every county I needed would move to a location I couldn't reach. I was afraid to send it in for repairs for fear that I would miss one of the last ones and so decided to hang on and hope for the best. With time, the word got around that I was crippled, and hams would go to the unreachable frequency and bring the mobile operator back so I might make a contact. That's county hunting!

Then there was the day when I slipped home for lunch and to try to make contact with Kalawao, Hawaii. Sure enough, the visiting ham was there, but so were seemingly hundreds of eager hunters. It was 11:25 and I could wait no longer without jeopardizing my job, so I blurted out over the air, "I only have 5 minutes left; can I please make a contact."

At that moment I learned what county hunting is really all about, as all over America voices without hesitation cried out, "Let him in; let him in. He only has 5 minutes left."

I made the contact and promised myself to repay this kindness someday. Many are the mobile operators who have said, "Just a minute. I'll turn around and go back for you."

The best of all was on August 18, 2000, when K4QFK, "Pete," asked me, "What's your last county?" and then drove 150 miles to get it for me and end this 7 year project. You see, that's what county hunting is about: It's making friends and helping others. Collecting counties is just to fill the spaces in between. *—KI7SN*

USA-CA Questions

Q: I have the 500 Basic Award and want to submit an endorsement for the 1000 county level. Will I have to organize the first 500 cards and have them checked again by two amateurs as well as having the second 500 checked?

A: If you can indicate which cards comprise the second 500, then the wit-

USA-CA Special Honor Roll

Charlie Calhoun, WØRRY
USA-CA All Counties #1010
October 6, 2000

Joyce Wilhelm, N9STL
USA-CA All Counties #1011
October 8, 2000

USA-CA Honor Roll

500
WØRRY 3130

1000
WØRRY 1559

1500
WØRRY 1298
N9STL 1299

2000
WØRRY 1198
N9STL 1199

2500
N3TA 1123
WØRRY 1124
N9STL 1125

3000
WØRRY 1029
N9STL 1030

The total number of counties for credit for the United States of America Counties Award is 3076. The basic award fee for subscribers is $6.00. For nonsubscribers it is $12.00. To qualify for the special subscriber rate, please send a recent CQ mailing label with your application. Initial application may be submitted in the USA-CA Record Book, which may be obtained from CQ Magazine, 25 Newbridge Road, Hicksville, NY 11801 USA for $2.50, or by a PC-printed computer listing which is in alphabetical order by state and county within the state. To be eligible for the USA-CA Award, applicants must comply with the rules of the program as set forth in the revised USA-CA Rules and Program dated June 1, 2000. A complete copy of the rules may be obtained by sending an SASE to Ted Melinosky, K1BV, 65 Glebe Road, Spofford, NH 03462-4411 USA. DX stations must include extra postage for airmail reply.

The Worked Ontario Ports award is presented for contacting stations located in the "Ports" of the province of Ontario, Canada.

The Lons-Le-Saunier award requires contacting three different French stations on nine HF bands--a tough one!

nesses need only verify those. Otherwise, the witnesses should be signing for verifying all of the cards. Some of the popular software programs allow you to assign a number to each new county to show what grouping it went into for awards purposes.

Q: The application book shows a summary page of counties worked by state. Is this necessary for endorsements?

A: It's enclosed to help you comply with the requirement for number of states needed for the lower levels of the award. For example, you need 25 states at the 1000 level. If you meet or exceed that level (and most do), then your endorsement request does not need the summary.

Q: The book also shows the Application Form and Certification Form. What is needed to make an endorsement to the award?

A: A photocopy or a written statement that says the same thing is sufficient.

DX Awards

Worked Ontario Ports Award. Contact stations located in the "Ports" of the Province of Ontario, Canada after January 1, 1990. North American amateurs must contact 5 plus 5 amateur stations in the province of Ontario (VA3/VE3). All others must contact 2 different "Port" stations plus 3 stations in the province of Ontario. All bands and modes okay. Contacts may be made with fixed, portable, or mobile stations. SWL okay. Visiting amateurs from other countries or provinces operating either fixed, portable, or mobile will count for the VE3/VA3 prefix. Sponsor VE3EIM counts as one "Port." If you activate a "Port" yourself, that counts towards the award as one "Port." Send list of contacts with date, time, mode, and location of station worked and fee of $US2 or $C2 to Robert Morden, VE3EIM, 106 Renny Cres., London, Ontario, Canada N6E 2C5.

The Peter the Great diploma commemorates the325th anniversary of this founder of St. Petersburg, Russia.

The Lons-le-Saunier Telegraphy Award 3/9. This is a tough one. It requires you to get to know three very band-versatile French stations as you follow them to get contacts on all of the HF bands. You have a chance, though, now that conditions on the higher bands are still good.

Lons-le-Saunier is the administrative capital of the Jura department of France, which is #39 in the listing of French "departments"—hence the 3 and 9 of the award requirements. Contact 3 different French stations on the following 9 HF bands: 160, 80, 40, 30, 20, 17, 15, 12, and 10 meters. SWL okay. These stations must reside in the Jura department, and one of them must reside in Lons-le-Saunier. A contact with special callsign TM5CW activated from Jura by a member, or a contact with a station operating from their twin city, Offenburg, Germany, may be used as a substitute for a Lons-le-Saunier station. Send GCR list and fee of $US 10, 10FF, or 10 IRC to: Dominique Meige, F5SJB, F-39130 Hautecour, France.

The Radio Amateur Association of St. Petersburg Series. Victor, N8OO, is handling the distribution of the following interesting awards from this St. Petersburg, Russia group. This avoids the problems that plague the Russian postal system. The certificates are printed on thick card stock in full color.

General Requirements: GCR list and fee of $US5 to Victor Petcherkin, 3712 Rigolette Road, Pineville, LA 71360. Endorsement fee for the Northern Palmyras is $US3 each.

Peter the Great Diploma. Issued in honor of the first Russian Emperor and founder of St. Petersburg, this award commemorates the 325th anniversary of his birth, but is a permanent award. Contact stations in the city of St. Petersburg and region of St. Petersburg. Each

The White Nights diploma is issued for contacting stations of the St. Petersburg and Leningrad region during the period of the "white nights," from May 20 to July 10 each year.

contact counts 10 points for Europeans and 20 points for all others towards the total of 325 needed to qualify. Therefore, Europeans will need 33 contacts and all others just 16.

White Nights Diploma. Contact stations of the St. Petersburg and Leningrad region during the period of the white nights, that period of time from May 20th to July 10th each year. Due to the extreme northerly position of these cities, at this time of year there is practically no darkness. One can explore the city at any time of the day or night without artificial lighting. Each contact with stations in these cities counts 2 points for Europeans and 4 points for all others. You need 50 points to qualify.

Northern Palmyra Award. Contact stations in different districts of St. Petersburg. The basic certificate requires 8 districts. This is a large award showing the bridge and various historical landmarks. There are two additional endorsements; one for 4 more districts and the other for the remaining 3 districts. These are the smaller certificates, which act as endorsements.

DX Sponsor Problems

I've always suggested writing in advance to award sponsors to see if their award is still available and the address is accurate. Six months ago, Albert Fry, GØVXX, wrote to the Wireless Institute of Australia, the Italian ARI, and the Romanian Amateur Radio Federation concerning awards in their National Programs. He's still waiting for a reply. These are three very well known and

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Contact stations in different districts of St. Petersburg, Russia to earn the Northern Palmyra award.

These certificates, which are smaller than the Northern Palmyra certificate, act as the endorsements to that award.

reputable organizations that have active paid or volunteer staffs to administer their programs. I'd be happy to share Al's letter with any representative of these groups.

Internet Site of the Month

EI7GL has assembled a montage of the awards offered by various Irish groups all in one spot on his page at: <http://www.qsl.net/ei7gl/> Grab your Irish QSL cards from your collection and spend an interesting hour at this internet destination. You may have already earned one or more of these awards.

I'm still looking for samples of awards from your group or club. Publicity is the name of the game, and we're offering you just that.

73, Ted, K1BV

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Contesting

BY JOHN DORR, K1AR

News/Views Of On-The-Air Competition

How Did You Rate Contesting in 2000?

January's Contest Tip of the Month

If you host a regular crew of guest operators, be sure to LISTEN to their input when suggesting improvements and/or problems with your station. There will be times when they recommend improvements that may cost you very little money but can dramatically improve the performance of your station. A good adage to remember is that "talk is cheap" (thanks to OH5JOC).

Despite all of the "noise" in the system about the demise of ham radio, lack of meaningful growth and our aging constituency, I think most of us will agree that last year was nothing short of spectacular in the world of contesting. I'd like to explore this concept in a bit more detail this month as we look at the health of contesting while moving into another calendar year.

Let's be up front by admitting that there are indeed some disturbing trends in our little universe. One of the intangible factors, which may seem a bit odd to you, is how I interpret what I see at each Dayton Hamvention™. With increasing regularity, I witness an aging group (by the way, this includes me, too) that returns each year with hair that's a little grayer. This year, for the first time, I noticed a growing number of folks who have joined the ranks of the retired (yes, there's some envy embedded in that comment). Most will agree that there are very few young guys, and virtually no one under the age of 30 attends the contest suites or dinners. Of course there are many other ways to look at this, including attendees at contest club meetings, the age we send in the All Asian DX Contest, our ARRL SS checks, etc.

With all of this being said, one could assume that contesting activity should mirror this apparent decline in other ham radio venues, right? Well, the results hardly suggest that. In fact, scores are escalating at an astonishing rate, with new records being set with regularity in nearly every major contest. So what's really going on, you ask, and was 2000 truly a good year for contesting?

2 Mitchell Pond Road, Windham, NH 03087
e-mail: <K1AR@contesting.com>

Calendar of Events

Dec. 16-17	Croatian CW Contest
Dec. 30-31	Stew Perry Topband Distance Challenge
Dec. 31	RAC Winter Contest
Jan. 1	ARRL Straight Key Nite
Jan. 6	Kid's Day Operating Event
Jan. 6-7	ARRL RTTY Round-Up
Jan. 12-14	Japan Int'l DX Contest 160–40 meters
Jan. 13-14	North America CW QSO Party
Jan. 20	LZ Open Contest
Jan. 20-21	North America SSB QSO Party
Jan. 20—22	ARRL Jan. VHF Sweepstakes
Jan. 21	HA DX Contest
Jan. 26-28	CQ 160M CW Contest
Jan. 27-28	REF CW Contest
Jan. 27-28	UBA DX SSB Contest
Feb. 17-18	ARRL CW DX Contest
Feb. 24-25	**CQ WW 160M SSB Contest**
Mar. 3-4	ARRL SSB DX Contest

Some Contributing Factors

The good news is that there have been some major contributors to the upside of contesting this past year. For starters, there's nothing like a solar maximum to pick up the pace of contesting. Now while this sunspot cycle hasn't exactly burned down the barn, a solar peak is still a solar peak. I'm still marveling at some of the QSOs we made in the CQ WW DX SSB Contest this fall, such as working 40 zones on 10 meters, logging a JT, and then HS as the clock approached midnight local time, which is spectacular from the East Coast.

The FCC's newly unveiled license restructuring program has also been a shot in the arm for HF contesting. The quantity of late-year checks (1995+) in the ARRL Sweepstakes is a good example. Another point would be the numbers of USA stations calling us in the CQ WW Contest in October. It was great to see new, excited HF operators who called in just to ask for a new state and a QSL. I'm sure the overseas competitors worked many more of these folks.

There are also many examples of increasing international activity over this past year. If you look at the new callsigns from countries such as England, Italy, Germany, and many others, I'm sure you'd agree. And while there has been some decline in activity from other parts of the world, it's being made up (and more) by impressive new activity in Europe.

When I became a ham in 1969, interest in DXing was rampant. It is, for so many of us, a key reason why we became interested in ham radio in the first place. In my opinion, nothing has changed for many new hams. The number of stations that have been worked during many of the recent high-profile DXpeditions is a good proof point for this unprecedented interest in DXing. Clearly, the appeal of working DX spills over into contesting. Also, 2000 was a great year for the integration of the two avocations, as K5K and A52B were both in the K1AR CQ WW log this past fall. Who would have thought that to be possible at the beginning of the year?

The WRTC 2000 event was clearly the crown jewel in contesting for last year. While it may appear to be a small event for a limited number of operators, WRTC 2000 created worldwide excitement for thousands. Increased camaraderie and contest enthusiasm was the real benefit of the WRTC experience, and those feelings will have a far-reaching impact on contesting beyond the year 2000 alone.

With the quality of log checking and reporting at all-time highs, contesting in 2000 benefited by significant improvements in the accuracy of logs across all contests. Peer pressure is always the best measure for getting "our act together," and the adjudicators of all contests are to be congratulated for the impact they've had on many of the recent year's contests in particular.

Closing Comments

Although it's easy to take a half-empty glass approach to the future state of contesting these days, when you think about it in positive terms, there's much to make us feel encouraged. Yes, the ball is in our court, and 2000 was a great year to leverage for the future. Think about that and what you can do as we enter a new year of contesting fun and challenge.

Well, that's all time and space will allow for this month. Like most of you, I think the future of contesting, while facing major challenges, is still bright. Propagation, too, remains our friend, promising a great year for contest operation. Why don't you strive to make 2001 *your* operating year, however you choose to define that! 73, John, K1AR

Year 2001 Contest Calendar

(Note: some dates may change pending updated contest announcements from the sponsors)

January

1	ARRL Straight Key Nite
6	Kid's Day
6–7	ARRL RTTY Round-Up
12–14	Japan Int'l DX Contest – 160–40 meters
13–14	North America CW QSO Party
20–21	North America SSB QSO Party
20–22	ARRL January VHF Sweepstakes
26–28	CQ 160 Meter CW Contest
27–28	REF CW Contest
27–28	UBA DX SSB Contest

February

4	North American SSB Sprint Contest
10–11	CQ/RJ WW RTTY WPX Contest
10–11	Dutch PACC Contest
11	North American CW Sprint Contest
17–18	ARRL International DX Contest CW
23–25	CQ 160 Meter SSB Contest
24–25	REF SSB Contest
24–25	UBA DX CW Contest

March

3–4	ARRL International DX Contest Phone
10–11	RSGB Commonwealth CW Contest
17–18	Bermuda Contest
17–18	Russian DX Contest
17–19	BARTG Spring RTTY Contest
17–19	Virginia QSO Party
24–25	CQ WW WPX SSB Contest

April

7–8	SP DX Contest
7–8	EA RTTY Contest
21–22	YU DX Contest
21–22	Michigan QSO Party
28–29	Helvetia DX Contest
28–29	Florida QSO Party

May

5–6	ARI International DX Contest
12–13	CQ-M International DX Contest
19–20	Baltic Contest
26–27	CQ WW WPX CW Contest

June

9–10	ANARTS WW RTTY Contest
9–11	ARRL June VHF QSO Party
16–17	All Asian CW DX Contest
23–24	ARRL Field Day

July

1	RAC Canada Day Contest
14–15	IARU HF World Championship
14–15	CQ WW VHF Contest
21–22	North American RTTY QSO Party
28–29	RSGB Islands On The Air Contest

August

4–5	ARRL UHF Contest
4–5	North American QSO Party
5	YO DX HF Contest
11–12	Worked All Europe CW DX Contest
11–12	Maryland – DC QSO Party
18–19	ARRL 10 GHz and Up Cumulative Contest
18–19	North American SSB QSO Party
18–20	NJ QSO Party
25–26	Ohio QSO Party

September

1–2	All Asian SSB DX Contest
9	North American CW Sprint Contest
8–9	Worked All Europe SSB DX Contest
8–9	ARRL September VHF QSO Party
15–16	Scandinavian Activity CW Contest
15–16	Washington Salmon Run
15–16	ARRL 10 GHz and Up Cumulative Contest
16	North American SSB Sprint Contest
16–18	Tennessee QSO Party
22–23	Scandinavian Activity SSB Contest
29–30	CQ/RJ WW RTTY DX Contest

October

6–7	California QSO Party
6–7	VL/ZL Oceania SSB Contest
6–7	Pennsylvania QSO Party
13–14	VK/ZL Oceania CW Contest
27–28	CQ WW DX SSB Contest

November

3–5	ARRL November Sweepstakes CW
10–11	WAE RTTY Contest
10–11	OK/OM DX CW Contest
17–18	LZ DX Contest
17–19	ARRL November Sweepstakes Phone
24–25	CQ WW DX CW Contest

December

7–9	ARRL 160 Meter Contest
15	OK DX RTTY Contest
15–16	ARRL 10 Meter Contest
15–16	Croatian CW Contest
16	RAC Canada Winter Contest

Propagation

BY GEORGE JACOBS, W3ASK

The Science Of Predicting Radio Conditions

CQ WW DX SSB Contest Critique

Flash!

The 2000 CQ World-Wide DX SSB Contest weekend of October 28–29 started off with a bang, duplicating last year's excellent conditions until 09 UT, when a minor radio storm somewhat degraded conditions for a three-hour period. HF propagation conditions improved again after 12 UT. Beginning at 21 UT on Saturday and continuing through 06 UT on Sunday, another period of minor storminess degraded conditions. They began to slowly improve again after 12 UT, reaching excellent conditions during the last three hours of the contest weekend. Although the sunspot cycle climbed to a higher level during 2000, periods of minor storminess at times reduced conditions during the SSB contest weekend to somewhat lower values than were observed during the record-breaking 1999 WW DX contest period.

Two periods of radio storminess, from 09–12 UT on October 28 and from 2100 UT on the 28th through 06 UT on the 29th, somewhat marred what otherwise might have been record-breaking conditions again during the 2000 WW DX SSB Contest period.

Key geomagnetic, solar, and ionospheric data recorded during the SSB contest weekend are summarized in Table I. Table II shows the worldwide Kp index of geomagnetic activity reported for each three-hour period for both contest days.

11307 Clara Street, Silver Spring, MD 20902
e-mail: <george@gjainc.com>

LAST-MINUTE FORECAST

Day-to-Day Conditions Expected for January 2001

	Expected Signal Quality			
Propagation Index.....	(4)	(3)	(2)	(1)
Above Normal: 5-6, 12, 19-20	A	A	B	C
High Normal: 2-4, 10-11, 18, 29-31	A	B	C	C-D
Low Normal: 1, 7-9, 15-17, 21-22, 25-26, 28	B	C-B	C-D	D-E
Below Normal: 13-14, 24	C	C-D	D-E	E
Disturbed: 23, 27	C-D	D	E	E

Where expected signal quality is:

A—Excellent opening, exceptionally strong, steady signals greater than S9.

B—Good opening, moderately strong signals varying between S6 and S9+, with little fading or noise.

C—Fair opening, signals between moderately strong and weak, varying between S3 and S9, with some fading and noise.

D—Poor opening, with weak signals varying between S1 and S6, with considerable fading and noise.

E—No opening expected.

HOW TO USE THIS FORECAST

1. **Find the *propagation index* associated with the particular path opening from the Propagation Charts appearing on the following pages.**
2. **With the *propagation index*, use the above table to find the expected signal quality associated with the path opening for any given day of the month. For example, an opening shown in the Propagation Charts with a *propagation index* of 3 will be fair to good (C-B) on Jan. 1st, good (B) on the 2nd, 3rd, and 4th; excellent (A) on the 5th and 6th, etc.**

How Were the Band Openings?

John Dorr, K1AR, *CQ*'s "Contesting" Editor, has provided this column with a summary of this observations during the contest weekend:

"Conditions were very good on Saturday and noticeably disturbed on Sunday. Clearly the bands were not as hot this year compared to last year, but that has more to do with the luck of the solar draw for a given weekend as opposed to our position in the current sunspot cycle. Even with disturbed conditions we were still able to engage in remarkable QSOs, especially on 10 meters, which was open to Central Asia (JT) and Southeast Asia (HS) up to midnight on the USA East Coast (04 UT). Note that we worked 978 QSOs on 10 meters on Saturday and only 275 contacts on Sunday. The contrast on 15 meters was not as bad between the two days. We did not work any 10 meter QSOs on Sunday until 1400 UT. In contrast, our first 10 meter European QSO on the first day took place at 1045 UT. Conditions were noticeably down on the low bands beginning Saturday evening. The bottom line is that considering only the conditions on Saturday, this would have been a great 24-hour contest!"

Thank you, John. Readers are referred to the "Contesting" column for more detailed information concerning the outcome of the 2000 CQ WW DX SSB Contest weekend.

Sunspot Cycle 23 Progress

The Royal Observatory of Belgium, the world's official keeper of sunspot records, reports a monthly mean sunspot

Geographical Area	October 28	October 29
Polar	Low/Below Normal*	Low/Below Normal*
Auroral	Low/Below Normal*	Low/Below Normal*
Middle Latitude	High/Low Normal	High/Low Normal
Low Latitude	High Normal	High Normal
Equatorial	Above/High Normal	Above/High Normal
10.7 cm Radio Flux	182	187
Daily Sunspot Number	106	113
WW Geomagnetic Ap Index	19	26
WW Geomagnetic Kp Index	3.1	2.6

** Brief periods of minor radio storminess were reported between 09–12 UT on October 28 and from 2100 on the 28th through 06 UT on October 29.*

Table I– Summary of HF propagation conditions based on reports from NOAA during the CQ WW DX SSB Contest weekend of October 28–29 and upon initial reports from contest participants.

Planetary Kp Index	UT 00–03	03–06	06–09	09–12	12–15	15–18	18–21	21–24
Oct. 28	2	0	3	5	4	3	3	5
Oct. 29	5	5	4	4	4	3	3	2

Table II– Worldwide geomagnetic indices (planetary Kp) reported every three hours during the SSB contest weekend of October 28–29. Levels 0 and 1 are exceptionally quiet; 2 quiet to unsettled; 3 unsettled; 4 active, and 5 minor storminess.

number of 110 for September 2000. The high for the month was 163, reached on September 24th. A low of 26 was recorded on September 11th. Cycle 23 continues to exhibit extremely wide variations on a day-to-day basis.

September's mean value results in a smoothed running sunspot number of 120, centered on March 2000. This is a three-point increase over the previous month. On the assumption that Cycle 23 peaked during July 2000 with a count of 121 and is now on its slow decline, a smoothed sunspot level of approximately 120 is forecast for January 2001.

Canada's Dominion Radio Astrophysical observatory in Penticton, B.C. reports a corresponding mean 10.7 cm solar flux level of 184 for September 2000. This results in a smoothed level of 181 centered on March 2000. A level on the order of 183 is forecast for January 2001.

Another Banner Year Expected for 2001

Sunspot Cycle 23, which began during May 1996, is believed to have reached a smoothed sunspot peak of 121 during July 2000. Based on this assumption, which will require several more months of data to confirm, Cycle 23 has now begun its slow decline.

According to the latest predictions made by the National Geophysical Data Center in Boulder, the New Year should begin with a smoothed sunspot count of 117, and drop slowly to an expected level of 108 by the end of 2001. By arbitrary definition, this is still considered to be a Very High level of sunspot activity.

The level of sunspot activity expected during 2001 should not significantly change HF propagation conditions from those observed in 2000. This portends that the new year will be another banner year for radio amateurs and other users of the HF spectrum.

The Best May Still Be At Hand

Here is a thumb-nail sketch of propagation conditions expected during 2001 on each amateur band between 6 and 160 meters.

6 meters: Increased *F2*-layer ionospheric DX openings to many areas of the world are expected during the daylight hours of 2001, particularly during the winter and equinox months. Improved short-skip openings are expected during the sporadic-*E* summer season.

10 meters: This should be another great year for 10 meters. As during 2000, expect an increasing number of DX openings for longer periods of time during the daylight hours, especially during the equinox and winter months. DX openings to many areas of the world should also be possible during the summer months, sometimes lasting well into the early evening hours. Expect improved short-skip openings during the summer sporadic-*E* season.

12 meters: Should behave very much like the 10 meter band, but open somewhat more frequently to more areas of the world and remain open for an hour or two longer.

15 meters: This will very likely continue to be the optimum DX band in 2001 for worldwide openings during the daylight hours of all seasons. Expect the band to remain open well into the evening hours, particularly during the summer months.

17 meters: Should behave much like 15 meters, but open more often and remain open for DX an hour or two longer.

20 meters: Always a great band, it is in its prime during periods of very high solar activity. Excellent conditions are expected on this band during the hours of daylight, with worldwide DX openings possible throughout the year. DX conditions on this band tend to peak for a few hours after local sunrise and again during the sunset period. During the summer months expect this band to remain open for DX well past midnight and often throughout the entire period of darkness. In the winter months of 2001 increased nighttime DX openings are also expected. At times it will be nip and tuck between 20 and 15 meters for the optimum DX bands.

30, 40, 80, and 160 meters: These are basically nighttime DX bands. Exceptionally good worldwide DX should continue on 30 and 40 meters from about two hours before sunset to approximately two hours after sunrise during all seasons. DX openings on 80 and 160 meters should peak during the hours of darkness during the equinox and winter months. Expect somewhat weaker and noisier signals, which are associated with increased sunspot activity on these bands.

January Conditions

It should be a toss-up among 10, 12, and 15 meters for DX propagation honors during the daylight hours. These bands should open to most areas of the world, often with very strong signals. Ten meters may have a slight edge before noon, with 12 and 15 meters being somewhat better after noon and becoming the optimum DX bands during the late afternoon hours. Short-skip openings between distances of approximately 1200 and 2300 miles should be excellent on 10 meters during most of the daylight hours. Excellent short-skip openings are also expected on 12, 15, and 17 meters from shortly after sunrise through the early evening hours for distances between 1000 and 2300 miles.

Excellent propagation conditions are expected on 20 meters for both DX and short-skip openings almost around the clock. DX conditions should peak during a window of an hour or two following sunrise, and again during the late afternoon and early evening hours. On many days the band should remain open well past midnight. Short-skip openings between approximately 1300 and 2300 miles should be possible from just after sunrise to as late as midnight. Shorter distance openings should also be possible from mid-morning to mid-afternoon.

The optimum band for DX conditions during the hours of darkness should be

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40 meters. Openings to most areas of the world are forecast from shortly before sundown, through the hours of darkness, and until shortly after sunrise. Signal levels may be exceptionally strong at times. During the daylight hours short-skip conditions should be optimum for openings between approximately 100 and 600 miles. Skip will lengthen during the late afternoon, and by nightfall short-skip conditions should be optimum for openings between 800 and 2300 miles.

Atmospheric noise levels are expected to be at seasonally minimum levels in the Northern Hemisphere during January. This should result in peak conditions on both the 80 and 160 meter bands. Expect some good openings to many parts of the world on 80 meters during the hours of darkness and the sunrise period. Short-skip openings between distances of 50 and 250 miles should be optimum on 80 meters during the daylight hours. During the later afternoon and early evening hours short-skip openings should increase to between 250 and 1500 miles, and by nightfall openings up to and beyond 2300 miles should be possible.

Expect some DX openings on the 160 meter band during the hours of darkness. Openings towards Europe and the east should peak at about midnight.

Openings towards the South Pacific and in a generally southerly direction may be possible just prior to daybreak. Short-skip openings up to 1300 miles should be possible during the hours of darkness, and frequently the skip will extend out as far as 2300 miles. During the daylight hours intense solar absorption will severely limit openings, although some may be possible at times up to 150 miles or so.

Short-Skip Charts

This month's column contains a Short-Skip Propagation Chart for use in the continental United States for distances between 50 and 2300 miles. Prediction charts centered on Hawaii and Alaska are also included. These charts are valid through February 2001. See last month's column for DX Propagation Charts for use during January.

VHF Ionospheric Openings

6 Meters. Solar activity is expected to be near peak intensity during January. This should result in some good DX openings on 6 meters to many areas of the world. Look for peak conditions towards Europe and Africa an hour or two before noon and towards the

HOW TO USE THE SHORT-SKIP CHARTS

1. In the Short-Skip Chart, the predicted times of openings can be found under the appropriate distance column of a particular meter band (10 through 160 meters) as shown in the left-hand column of the chart. For the Alaska and Hawaii Charts the predicted times of openings are found under the appropriate meter band column (15 through 80 meters) for a particular geographical region of the continental USA as shown in the left-hand column of the charts. An * indicates the best time to listen for 80 meter openings.

2. The propagation index is the number that appears in ( ) after the time of each predicted opening. On the Short-Skip Chart, where two numerals are shown within a single set of parentheses, the first applies to the shorter distance for which the forecast is made, and the second to the greater distance. The index indicates the number of days during the month on which the opening is expected to take place, as follows:

(4) Opening should occur on more than 22 days
(3) Opening should occur between 14 and 22 days
(2) Opening should occur between 7 and 13 days
(1) Opening should occur on less than 7 days

Refer to the "Last Minute Forecast" at the beginning of this column for the actual dates on which an opening with a specific propagation index is likely to occur, and the signal quality that can be expected.

3. Times shown in the charts are in the 24-hour system, where 00 is midnight; 12 is noon; 01 is 1 AM; 13 is 1 PM, etc. In the Short-Skip Chart appropriate *standard* time is used at the path midpoint. For example on a circuit between Maine and Florida, the time shown would be EST, on a circuit between New York and Texas, the time at the midpoint would be CST, etc. Times shown in the Hawaii Chart are in HST. To convert to standard time in other USA time zones add 2 hours in the PST zone; 3 hours in the MST zone; 4 hours in the CST zone; and 5 hours in the EST zone. Add 10 hours to convert from HST to GMT. For example, when it is 12 noon in Honolulu, it is 14 or 2 PM in Los Angeles; 17 or 5 PM in Washington, D.C.; and 22 GMT. Time shown in the Alaska Chart is given in GMT. To convert to *standard* time in other areas of the USA subtract 8 hours in the PST zone; 7 hours in the MST zone; 6 hours in the CST zone; and 5 hours in the EST zone. For example, at 20 GMT it is 15 or 3 PM in New York City.

4. The Short-Skip Chart is based upon a transmitted power of 75 watts CW or 300 watts PEP on sideband; the Alaska and Hawaii Charts are based upon a transmitter power of 250 watts CW or 1 KW PEP on sideband. A dipole antenna a quarter-wavelength above ground is assumed for 160 and 80 meters, a half-wave above ground on 40 and 20 meters, and a wavelength above ground on 15 and 10 meters. For each 10 dB gain above these reference levels, the *propagation index* will increase by one level; for each 10 dB loss, it will lower by one level.

5. Propagation data contained in the charts has been prepared from basic data published by the Institute for Telecommunication Sciences of the U.S. Dept. of Commerce, Boulder, Colorado 80302.

CQ Short-Skip Propagation Chart
January & February 2001
Local Standard Time At
Path Mid-Point (24-Hour Time)

Band	*Distance From Transmitter (Miles)*			
(Meters)	*50-250*	*250-750*	*750-1300*	*1300-2300*
10	Nil	Nil	07-08 (0-1) 08-09 (0-2) 09-10 (0-3) 10-12 (0-4) 12-15 (0-3) 15-17 (0-2) 17-18 (0-1)	07-08 (1) 08-09 (2-3) 09-10 (3-4) 10-12 (4) 12-15 (3-4) 15-16 (2-4) 16-17 (2-4) 17-18 (1-3) 18-19(0-3) 19-20(1-2) 20-21(0-1)
15	Nil	07-08 (0-1) 08-10 (0-2) 10-15 (0-3) 15-17 (0-2) 17-18(0-1)	06-07 (0-1) 07-08 (1-3) 08-10 (2-4) 10-15 (3-4) 15-17 (2-4) 17-18 (1-4) 18-19 (0-3) 19-21 (0-1)	06-07 (1) 07-08 (3-2) 08-18 (4) 18-19 (3) 19-21 (1-3) 21-23 (0-1)
20	09-11 (1-2) 11-14 (1-3) 14-15 (1-2) 15-17(0-1)	06-07 (0-2) 07-09 (0-3) 09-11 (2-4) 11-14 (3-4) 14-15 (2-4) 15-17 (1-4) 17-19 (0-3) 19-20 (0-2) 20-06 (0-1)	06-07 (2-3) 07-08 (3) 08-09 (3-4) 09-17 (4) 17-19 (3-4) 19-20 (2-4) 20-21 (1-4) 21-23 (1-3) 23-02 (1-2) 02-06 (1)	06-07 (3-2) 07-08 (3) 08-12 (4) 12-14 (4-3) 14-21 (4) 21-23 (3-4) 23-01 (2-3) 01-04 (1-2) 04-06 (1)

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40	07-08 (0-2) 08-09 (1-3) 09-10 (2-4) 10-19 (4) 19-21 (2-3) 21-00 (1-2) 00-07 (0-1)	07-08 (2-3) 08-09 (3) 09-11 (4-3) 11-15 (4-2) 15-19 (4) 21-00 (2-4) 00-02 (1-3) 02-06 (1-2) 06-07 (1-3)	07-08 (3) 08-09 (3-2) 09-11 (3-1) 15-17 (4-2) 17-18 (4-3) 18-00 (4) 00-02 (3-4) 02-06 (2-4) 06-07 (3-4)	07-08 (3-1) 08-15 (1-0) 15-17 (2-1) 17-18 (3) 18-06 (4) 06-07 (4-3)
80	07-08 (2-4) 08-10 (4) 10-15 (4-3) 15-00 (4) 00-04 (3-4) 04-07 (2-3)	07-08 (4-3) 08-09 (4-2) 09-10 (4-1) 10-15 (3-1) 15-16 (4-1) 16-18 (4-2) 18-04 (4) 04-07 (3-4)	07-08 (3-1) 08-09 (2-0) 09-16 (1-0) 16-18 (2-1) 18-20 (4-3) 20-06 (4) 06-07 (4-3)	07-08 (1-0) 08-16 (0) 16-18 (1-0) 18-20 (3-2) 20-04 (4) 04-06 (4-3) 06-07 (3-1)
160	09-17 (1-0) 17-19 (3-2) 19-06 (4) 06-08 (3) 08-09 (2-1)	17-18 (2-1) 18-19 (2) 19-21 (4-3) 21-05 (4) 05-06 (3) 06-07 (3-2) 07-08 (3-1) 08-09 (1-0)	17-18 (1-0) 18-19 (2-1) 19-21 (3-2) 21-03 (4-3) 03-05 (4) 05-06 (3-2) 06-07 (2-1) 07-08 (1-0)	18-19 (1-0) 19-21 (2-1) 21-03 (3) 03-05 (4-2) 05-06 (2-1) 06-07 (1-0)

ALASKA
November & December 2001
Openings Given in GMT#

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	17-18 (1) 18-20 (2) 20-22 (3) 22-00 (2) 00-01 (1)	15-16 (1) 16-17 (2) 17-21 (3) 21-23 (4) 23-00 (3) 00-01 (2) 01-02 (1)	12-16 (1) 16-18 (2) 18-21 (1) 21-23 (2) 23-02 (3) 02-03 (2) 03-05 (1)	06-12 (1) 07-11 (1)*
Central USA	17-18 (1) 18-20 (2) 20-00 (3) 00-01 (2) 01-02 (1)	15-16 (1) 16-17 (2) 17-20 (3) 20-23 (4) 23-01 (3) 01-02 (2) 02-03 (1)	12-16 (1) 16-18 (2) 18-20 (1) 20-22 (2) 22-00 (3) 00-02 (4) 02-03 (3) 03-04 (2) 04-06 (1)	06-08 (1) 08-13 (2) 13-14 (1) 07-12 (1)*
Western USA	18-19 (1) 19-20 (2) 20-21 (3) 21-23 (4) 23-00 (3) 00-01 (2) 01-02 (1)	16-17 (1) 17-18 (2) 18-20 (3) 20-01 (4) 01-02 (3) 02-03 (2) 03-04 (1)	12-16 (1) 16-18 (2) 18-22 (3) 22-02 (4) 02-04 (3) 04-05 (2) 05-07 (1)	04-05 (1) 05-06 (2) 06-14 (3) 14-15 (2) 15-16 (1) 05-10 (1)* 10-14 (2)* 14-15 (1)*

HAWAII
November & December 2001
Openings Given in Hawaiian Standard Time#

To:	10 Meters	15 Meters	20 Meters	40/80 Meters
Eastern USA	07-08 (1) 08-09 (2) 09-13 (4) 13-14 (3) 14-15 (2) 15-16 (1)	06-07 (1) 07-09 (4) 09-12 (3) 12-15 (4) 15-17 (3) 17-18 (2) 18-19 (1)	12-14 (2) 14-17 (4) 17-21 (3) 21-00 (2) 00-06 (1) 06-08 (3) 08-09 (2) 09-12 (1)	17-18 (1) 18-20 (2) 20-02 (3) 02-03 (2) 03-04 (1) 19-20 (1)* 20-01 (2)* 01-03 (1)*
Central USA	07-08 (1) 08-09 (2) 09-15 (4) 15-16 (3) 16-17 (2) 17-18 (1)	06-07 (1) 07-09 (4) 09-13 (3) 13-17 (4) 17-19 (3) 19-20 (2) 20-21 (1)	08-13 (2) 13-14 (3) 14-20 (4) 20-00 (3) 00-02 (2) 02-05 (1) 05-06 (2) 06-08 (3)	17-18 (1) 18-20 (2) 20-21 (3) 21-01 (4) 01-03 (3) 03-04 (2) 04-06 (1) 19-20 (1)* 20-22 (2)* 22-01 (3)* 01-03 (2)* 03-05 (1)*
Western USA	07-08 (1) 08-09 (2) 09-16 (4) 16-17 (3) 17-18 (2) 18-19 (1)	06-07 (1) 07-08 (2) 08-12 (3) 12-18 (4) 18-20 (3) 20-21 (2) 21-22 (1)	08-10 (4) 10-15 (3) 15-22 (4) 22-01 (3) 01-04 (2) 04-06 (1) 06-08 (3)	17-18 (1) 18-19 (2) 19-20 (3) 20-03 (4) 03-05 (3) 05-06 (2) 06-07 (1) 19-20 (1)* 20-21 (2)* 21-04 (3)* 04-05 (2)* 05-06 (1)*

#See explanation in "How To Use Short-Skip Charts" in the box at the beginning of this column.
* Indicates best time to listen for 80 meter openings. Openings on 160 meters are also likely to occur during those times when 80 meter openings are shown with a propagation index of (2) or higher.
Check for 6 meter openings at times when the 10 meter forecast rating is shown as (4).
For 12 meter openings interpolate between 10 and 15 meter openings.
For 17 meter openings interpolate between 15 and 20 meter openings.
For 30 meter openings interpolate between 40 and 20 meter openings.
Note: The Alaska and Hawaii Propagation Charts are intended for distances *greater* than 1300 miles. For shorter distances use the preceding Short-Skip Chart.

Caribbean area and Central and South America from an hour or two before, to about an hour or two after, noon. Look for possible 6 meter openings towards the Pacific, Australasia, and possibly the Far East during the later afternoon hours. Trans-continental openings should be possible beginning at about noon. Chances are best for 6 meter openings on those days expected to be High or Above Normal (see the Last-Minute Forecast at the beginning of this column).

Meteors. Chances for meteor-scatter VHF openings should be pretty good between January 1st and 5th, coincident with the occurrence of the *Quadrantids* meteor shower. This is expected to be a major shower, which should peak on January 3rd with a count of as many as 120 meteors an hour.

Tran-Equatorial. Not many trans-equatorial (TE) openings are expected this month, since a seasonal slump usually occurs during January. Some infrequent openings may be possible, however, between southern tier states and countries well south of the equator in this hemisphere. The best time to check for TE openings on 6 meters is between 7 and 10 PM local time.

Auroras

As noted during the summer and fall months, widespread auroras increase considerably near the peak of a sunspot cycle. This is expected to continue during January when HF conditions are Below Normal or Disturbed. Check the Last-Minute Forecast at the beginning of this column for predicted dates. Check the website <http://www.spaceweather.com> for aurora alerts and real-time maps of aurora data.

Propagation conditions on the HF bands should get off to a good start during January 2001, and they are expected to remain at the exceptionally high level throughout the New Year.

73, George, W3ASK

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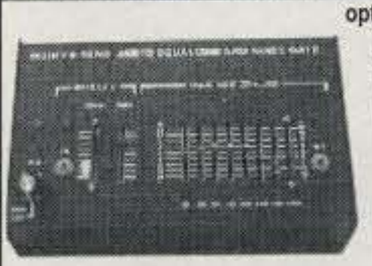

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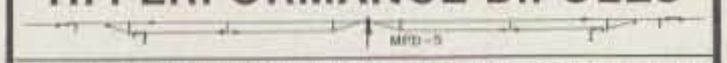

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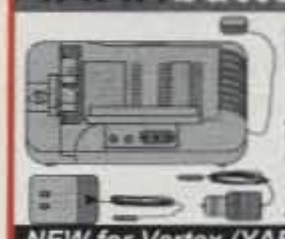

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PB-2h NiMH pk.	8.4v	1200mAh	$39.95
NEW for KENWOOD TH-2500 / 2600: EXCLUSIVE !				
PB-25s NiMH pk.	8.4v	1200mAh	$39.95
Packs for ALINCO DJ-580 / 580T / 582 / 180 / 280T etc.:				
EBP-20nh NiMH pk.	7.2v	1800mAh	$32.95
EBP-22nh 5W NiMH pk.	12.0v	1500mAh	$36.95
EDH-11	6-Cell AA case		$14.95
For YAESU FT-50R / 50RD / 40R / 10R etc.:				
FNB-41xh NiMH pk.	9.6v	1100mAh	$45.95
For YAESU FT-51R / 41R / 11R etc.:				
FNB-33xh NiMH pk.	4.8v	2000mAh	$39.95
FNB-38 5W NiMH pk.	9.6v	700mAh	$39.95
For YAESU FT-530 / 416 / 415 / 816 / 76 / 26 etc.:				
FNB-25x NiMH pk.	7.2v	1000mAh	$28.95
FNB-26xs NiMH pk.	7.2v	1800mAh	$36.95
For YAESU FT-411 / 470 / 73 / 33 / 23 etc.:				
FNB-10 NiCd pk.	7.2v	600mAh	$20.95
FNB-11 5W NiCd pk.	12.0v	600mAh	$24.95
FBA-10	6-Cell AA case		$14.95

NEW- the IQ-9000 Charger & Conditioner for AA & AAA batteries! $22.95
(1) Desktop unit can charge or condition up to 4 NiMH or NiCd cells!
(2) Has selectable conditioning feature !
(3) Provides safe, quick charge for cells!
(4) Automatic shut-off at end of charge!
(5) UL-listed power supply included!

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"Brick-Wall" Selectivity

Today's elite-class operators demand the best RF weaponry available. Yaesu's exciting new MARK-V FT-1000MP answers the call, with an expanded array of receiver filtering, 200 Watts of power output, and Class-A SSB operation capability for the cleanest signal on the band. Enhanced front-panel ergonomics save you seconds in a pile-up or a contest "run," and Yaesu's HF design and manufacturing know-how ensures that no short-cuts have been taken in our effort to bring you the best HF transceiver money can buy. For more QSOs in your log, and more awards on your wall, there is only one choice: the MARK-V FT-1000MP from Yaesu!

I. IDBT: Interlocked Digital Bandwidth Tracking System

The IDBT feature greatly simplifies operation by matching the bandwidth of the DSP (Digital Signal Processing) system to the net bandwidth of the 8.2 MHz and 455 kHz IF stages. The IDBT system accounts for the settings of the IF WIDTH and SHIFT controls, and automatically sets a DSP bandwidth which matches the analog IF bandwidth.

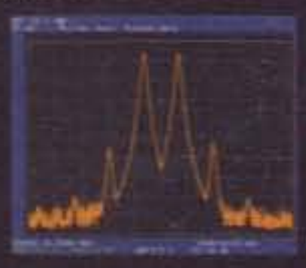
IDBT: A Breakthrough in Selectivity!

II. VRF: Variable RF Front-End Filter

Protecting the MARK-V's receiver components from strong out-of-band signals, the VRF system acts as a high-Q "Preselector," located between the antenna and the main bandpass filter networks, providing additional RF selectivity on the 160-20 meter Amateur bands for multi-operator contest teams, DX-peditions, or for operation near MW/SW broadcast stations.

III. 200 Watts of Transmitter Power Output

Utilizing two Philips® BLF147 Power MOSFETs in a 30-Volt, push-pull configuration, the MARK-V's transmitter puts out up to 200 Watts of clean output power, thanks to the conservative design of the PA section.



Class A 75 W PEP IMD

IV. Class-A SSB Operation

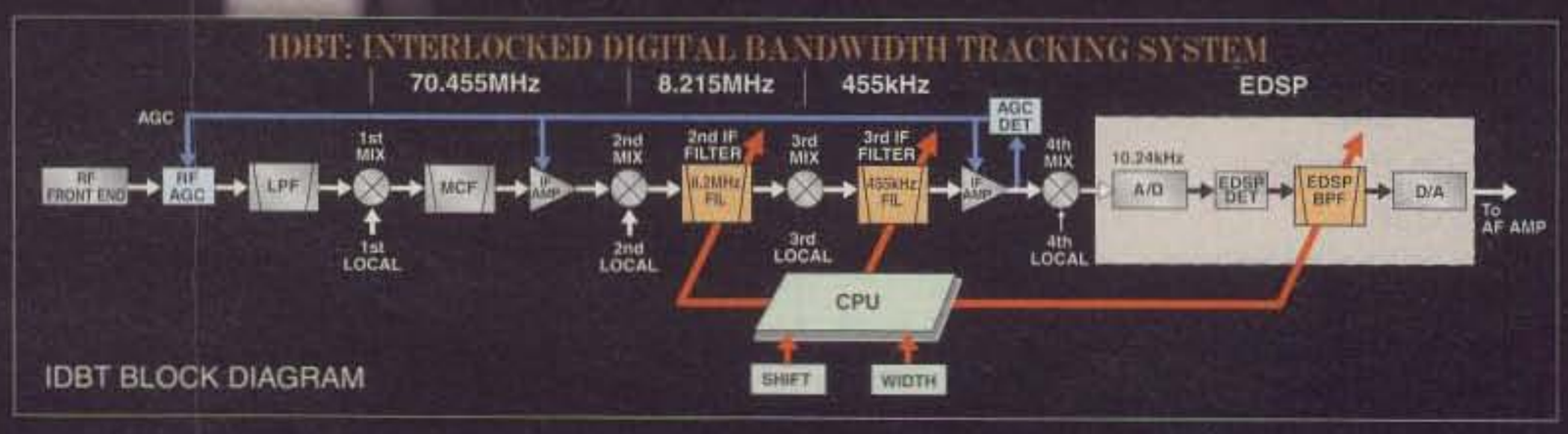
Exclusively available on the MARK-V FT-1000MP , a press of a front-panel button engages Class-A SSB operation of the transmitter, at a power output level of 75 Watts. Class-A operation produces incredibly clean signal quality, with 3rd- order IMD suppressed 50 dB or more, and 5th- and higher-order products typically down 80 dB or more!

V. Multi-Function Shuttle Jog Tuning/ Control Ring

The immensely-popular Shuttle Jog tuning ring, which is concentric with the Main Tuning Knob, has a new look in the MARK-V: it now includes the activation switches for the VRF (left side) and IDBT (right side) features, so you don't have to move your hand position to activate these important circuits during contest or pile-up situations!

HF 200 W All-Mode Transceiver

MARK-V FT-1000MP



IDBT BLOCK DIAGRAM

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The Ultimate Backpacker!

Ham Radio in the Great Outdoors: It's the Best with Yaesu's FT-817!

Actual Size

Bring Ham Radio along on your next hiking, camping, or business trip with Yaesu's amazing new FT-817 Multimode HF/ VHF/ UHF Portable Transceiver!

●ULTRA COMPACT: Measuring just 5.3" x 1.5" x 6.5" WHD (135 x 38 x 165 mm) and weighing about 2 1/2 pounds (1.17 kg, including the supplied antenna and alkaline cells), the FT-817 is small and light enough to take along wherever you're going.

●WIDE FREQUENCY COVERAGE: 160-10 meters on HF, plus the 50, 144, and 430 MHz Amateur bands. Plus FM Broadcast, AM Aircraft, and Public Safety receiver coverage.

●MULTIMODE DESIGN: Ready for action on SSB, CW, AM, FM, FM-Wide (Rx), 1200/9600 bps Packet, and Digital, including dedicated USB and LSB PSK-31 configurations.

●5 WATTS POWER OUTPUT: Using a new-technology all-band MOS FET power amplifier, the FT-817 provides 5 Watts of power output when using a 13.8 Volt DC source. When using Alkaline batteries or the optional FNB-72 Ni-Cd Battery Pack, power is automatically set to 2.5 Watts: via Menu, this can be changed to 0.5 Watt, 1 Watt, or up to 5 Watts.

●WIDE CHOICE OF POWER SOURCES: The FT-817 is equipped with an alkaline "AA" cell battery case, and a 13.8 volt DC cable is also supplied. Available as an option is the FNB-72 Ni-Cd Battery Pack (9.6 V, 1000 mAh), which can be recharged using a 13.8 Volt power supply while the radio is being operated.

●TWO ANTENNA PORTS: A "BNC" connector is provided on the front panel, and a type "M" connector on the rear panel, with Menu selection of which connector will be assigned for operation on HF, 50 MHz, 144 MHz, and 430 MHz.

●OPTIONAL 10-POLE COLLINS MECHANICAL FILTERS: An optional filter slot is provided, accommodating either the YF-122S (2.3 kHz) SSB filter or the YF-122C(500 Hz) CW filter. You get "base station" performance even from a mountain top.

●INCREDIBLE MEMORY RESOURCES: You get a total of 208 memories, including 200 "regular" memories which may be separated into ten groups of up to 20 channels each. And you can append an Alpha-Numeric "Tag" to each memory to aid in channel identification.

●A CW OPERATOR'S DREAM MACHINE: You get a built-in Electronic Keyer with adjustable weighting, adjustable CW Pitch, CW Normal/Reverse frequency tuning, and you can even use the microphone's UP and DOWN keys to send CW via the Keyer.

●BUILT-IN CTCSS AND DCS: The built-in CTCSS and DCS Encoder/Decoder systems provide you with the versatility you need for repeater access or selective calling.

●DUAL - COLOR LIQUID CRYSTAL DISPLAY: Select from Blue or Amber display illumination, which can also be switched off to conserve battery life. And while you're away, the Spectrum Scope will provide you with a visual record of activity ±5 channels from your current operating frequency.

See the exciting new FT-817 at your Yaesu Dealer's showroom today!

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FT-817

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Advanced dual bander

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- 200 Memories
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- Wide Rx†

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Super small size, big sound

- 2M/440MHz
- Mini Size
- Big Audio
- 30 to 1300 MHz Rx† (Cell Blocked)
- Advanced Scanning
- Includes "AA" Ni-Cds, Charger
- Work One Band at a Time

IC-T22A
Shirt pocket small, big performance

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- Easy to Use
- Alphanumeric Display
- Wide Rx ,Air Band†
- 5W@13.5V DC*
- 3W@9.6V DC Standard
- 80 Memory Channels

IC-T81A
World's first QUAD band HT

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- Ni-Mh Battery
- Auto Repeater
- Water Resistant

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- Super Rugged
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- 500 mW Audio
- 8 Front Panel PC Programmable* Keys
- 2 AA Ni-Cds & Wall Charger Included
- Our most affordable

WORK THE MAGIC

IC-T7H
Powerful performance

- 2M/440 MHz
- Easy to Use
- Up to 6 Watts
- Work One Band at a Time
- Air Band Rx†
- Pocket Beep
- Auto Repeater

There's something magical about amateur radio. The fact that you can speak into a little box and communicate with someone else on the other side of town, or even on the other side of the world, with nothing between you and that person but thin air…what an incredible, powerful feeling. It feels like magic.

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- V/U, U/V, Dual Band, Cross Band Repeat
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IC-207H
Super compact, detachable control panel*

- 2M/440MHz
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- Work One Band at a Time
- Up to 9600 bps Packet*
- Air Band RX†
- MIL STD 810††

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